# GAS JOURNAL

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## THE WASTE HEAT TURBINE

THE recovery of waste heat from the continuous vertical retort bench in the form of electric power can add to the already very high thermal efficiency of this system. In his paper presented to the Institution of Gas Engineers in June last, Dr. J. Burns indicated that he had very much in mind the possibilities of the gas turbine. It had been the practice of the North Thames Gas Board to run the electricity generating systems of its larger works in parallel with the grid supply of the British Electricity Authority. The way was therefore clear to develop to the limit the utilisation of waste heat in the generation of electricity with the proviso that it should really be waste heat and not additional heat obtained by wasteful consumption of good quality fuel in the producers. Works equipped with continuous vertical retorts operating with a fuel consumption of 10% to 12% are already able to raise steam in the normal waste heat boiler sufficient to produce 25 kWh per ton of coal carbonised as well as meeting all the needs of process steam when making gas at 500 B.Th.U. per cu.ft. If the working pressure and temperature of these boilers are increased to 300 lb. per sq. in. and 600°F. respectively, this figure could be raised to 30 kWh. With complete electrification of works with the normal proportion of retort plant and carburetted water gas plant Dr. Burns estimated that power requirements would be from 18 to 22 kWh per ton of coal treated, so that there would still be electricity available for export to the grid supply. It is now recognised that development on these lines can make an appreciable contribution to the national demand for electricity with a significant improvement in the overall national coal efficiency of generation.

'The advent of the gas turbine,' he continued, 'has introduced interesting possibilities for the direct conversion of waste heat into electrical energy. This type of machine is well suited to the temperature range of the waste gases leaving a continuous vertical retort setting, and by the installation of such a machine, in conjunction with a steam turbine for utilising the lower grade heat, the indications are that it should be possible to generate between 50 and 70 kWh per ton of coal carbonised.'

That is the whole overwhelming case for the waste heat gas turbine. The system described by Mr. A. W. Pope, of Messrs. W. H. Allen, to the London Section of the Institution is the one which apparently is to be tried out in a North Thames works. It is not unlike that which has been designed for Coventry where it might now be installed if it were not that the phenomenal demand for plant had necessitated the quicker installation of more normal plant. The choice of the closed cycle with heated air as the working fluid is understandable when it is realised that the fluid enters the turbine at a pressure of something like 125 lb. per sq. in. Waste gases leave the settings at about 850°C. This temperature is reduced in a heat interchanger to 475°C., heat being transferred to the working air which enters the turbine at 600°C. The air itself is drawn in through a filter, passes through a compressor, in one or two stages, to the heater, and is then expanded through the turbine. It passes again through the heat interchanger to a low pressure boiler and an economiser which serves all the boilers. The waste gases themselves are still hot enough to give good service in a waste heat boiler of the normal type.

The closed cycle has, of course, the great advantage that only clean air comes into contact with the turbine blades, which should conduce to a maximum life. And there is the further advantage that the air pressure in the circuit never goes below two atmospheres, with the result that the volume to be dealt with in compressors and other parts of the plant is less than half what it would be in an open cycle. These parts are therefore comparatively small and high power outputs can be obtained from equipment with low centrifugal stresses.

The system, its method of working, and its relation to gas turbines of other types are admirably set out in Mr.

Pope's paper. It is an understatement to say that 'it would seem to be worth while to spend time and money' on so interesting and promising a development as this. There is indeed good promise for a mixed gas and steam turbine system in connection with the continuous vertical retort on a sufficiently large scale. It should be noted that this is one more of the instances in which the constructional side of the industry is putting effort and risk into the advancement of high efficiency in gasworks practice.

## HIGHLY SKILLED TECHNIQUE

IN the discussion—see later pages—Captain W. Gregson gave some interesting details of the plant now under construction for Coventry. First of all it is good to note that the work on this prototype is well on the way and that we may expect to see it running towards the end of this year. No doubt there will be some teething troubles. One wonders, for example, how the alloy steel selected for the hot section of the main air preheater will stand up to the exacting conditions of 850°C., say 1,550°F., higher we think than anything applied to such frail structures as tubes in even high temperature boiler practice, though not so high as have been negotiated with more or less success in some metallic superheaters. Then the gasworks turbine will differ, as Mr. Taylor hinted, from most of the turbines used in aeronautics and even in industrial standby power plant, in that it will be expected to have a life reckoned in years rather than some hundreds of hours. Mr. Pope reassures us on this point. He is thinking of 15 to 20 years. And he does not consider that the noise of running will be such as to constitute a nuisance. The enormous quantity of water mentioned by Captain Gregson will call for special and careful treatment.

Reflecting on the gas turbine in general we in the gas industry are not likely to look with much comfort on the prospect of burning coal or crude oil in a combustion chamber leading direct to the turbine blades. Our faith is in a clean, refined fuel—a gaseous fuel. The prospect of a producer working under pressure is not very attractive either, though we may be driven to converting low grade coal, even peat, into gas by the producer rather than by the carbonisation method. All these problems are avoided in the two arrangements of the waste gas turbine which we have before us.

Finally we may be forgiven for being a little startled by the rapid development of highly complicated, intricate machinery of plant in the retort house. In the last few decades the manning of the retort plant has been passing out of the hands and control of the foreman stoker into those of the highly trained technician. As in other industries so in the gasworks soaring prices of raw materials have compelled refinements in the retort bench itself, in its equipment, in instrumentation, in automatic and close control of the process—all resulting in higher capital cost which yet has resulted in an enhanced efficiency which has kept the cost of gas within the very modest limits of the increases in selling prices so far experienced. But it all calls for a personnel of skill and training which may exceed our resources unless we renew our efforts in recruiting and education. In all these developments materials of construction, precision of fabrication, accuracy in building will be strained within a narrower margin of safety. Constant and meticulous supervision is necessary to secure the advantages claimed. We cannot afford to economise in the provision of technical staffs equal to these demands upon them.

## TARIFF POLICIES

SUBSTANTIAL progress by the area boards in finding uniform structures for their tariffs was recorded in the report of the Gas Council for the year ended last March. Further headway has been made in recent months, hindered unfortunately by the necessity to raise prices all round to keep pace with ever increasing costs entirely beyond the control of the boards. Only in exceptional cases—and North Thames, with its strong Gas Light and Coke Company foundation, is certainly an exception—is it possible to contemplate uniformity in price throughout an area, much less throughout the country. Uniformity of price is a wholly different problem from uniformity in the structure of a tariff and one which, as a long term policy, requires the most careful consideration. It is associated primarily with inherent differences in the costs of manufacture and distribution in different localities. The diversity in the approach to the tariff problem by the various boards may be a healthy sign of the extent of decentralisation which the gas industry enjoys, but we still believe that sooner or later the best in each board's structure will become more generally adopted, and the defects will be remedied. For instance, as we indicated last week, we cannot see the advantages of a single board having different sets of boundaries—for zones and groups—overlapping. Meter rents, prepayment differentials, and cash discounts are matters of common concern to all 12 boards, and it is a little puzzling to understand why in these enlightened days one board should begin to charge meter rents when another decides to discontinue them; again one board is abolishing cash discounts and another is introducing them.

The West Midlands Board has reduced its tariffs from 71 to 10 and devised a new block rate tariff in stages of 45, 405, 4,050, 11,250, and 15,750 therms per quarter. The price gradient differs both from block to block and between districts, and the tariff is applicable to all users, in the sense that any of the larger consumers who enter into special agreements for further reductions for larger quantities must first consume 25,000 therms per quarter at the tariff rates. In the Potteries the price stages are 12.75d. per therm for the first 45 therms per quarter, 11d. for the next 405, 10.25d. for the next 4,050, 9.5d. for the next 11,250, and 8.5d. for all over 15,750; while in some of the more rural areas the comparable stages are to be charged at 24d., 20.5d., 19.25d., 18.25d., and 16.75d. Latest news of a tariff revision comes from the Northern Board which, having effected an all round increase in 'published prices' has modified its tariff gradient and drawn a distinction between winter and summer stages. The

new scale is: For the first 30 therms per quarter, the published price; for 30 to 5,000 therms in a winter quarter or 30 to 2,000 therms in a summer quarter, two-thirds of the published price; 5,000 to 10,000 in winter or 2,000 to 5,000 in summer, three-fifths of the published price; for all in excess of 10,000 therms per winter quarter, 55% of the published price, and for all in excess of 5,000 therms in a summer quarter, one-half of the published price. Instead of an all round supplementary charge of 1d. per therm for prepayment consumers there will be a supplementary of 1¼d. on the first 30 therms per quarter and the Board is continuing the further supplementary of 1d. per therm to prepayment consumers using Board's fittings or apparatus.

The Southern Board has modified a tariff introduced last March on the ground that certain aspects of it could be held to be promotional, and in these days of shortages it is felt that the tariff should be less promotional. In three of the four divisions the first 40 therms per quarter are to be charged at the published price, with reductions thereafter according to quantity consumed; in the fourth it is not possible to give a reduction until after the first 250 therms per quarter without a considerable rise in the published price.

## *CONSULTATIVE COUNCILS' PROTESTS*

STILL more gas boards join the melancholy procession of those forced to raise their prices as a direct result of the increased cost of coal. On later pages of this issue we record the meetings (by coincidence on the same day) of consultative councils at opposite ends of the country—Northern and Southern areas—both of which passed resolutions of protest couched in the strongest terms to the Minister of Fuel and Power at the discriminatory coal price structure.

Addressing his area consultative council at a special meeting at Southampton called to consider proposals for raising the price of gas, Mr. Owen R. Guard (Chairman of the Southern Gas Board) described the N.C.B. coal price structure as a 'complicated formula modified by certain arbitrary factors and adjustments for commercial considerations which have not been disclosed.' None will disagree with the need for paying a fair wage for the hazardous task of winning coal. Every one will be in sympathy with the introduction of holidays with pay and a pension scheme for mine workers. But, as Mr. Guard so rightly asserted, these additional costs should not have been imposed in such a manner until after the Ridley Committee had given further consideration to the whole aspect of national fuel policy. The effect of this new price structure is to throw a heavy burden on the gas industry which, on the face of it, is out of all proportion to that placed on competitive industries.

The Southern Gas Consultative Council was not slow to observe that its area, in common with others remote from coalfields, was already paying more for its coal. The weighted average increase is now 7s. 5d. per ton. The Council refused to 'approve' the Board's proposals, but it 'accepted' as inevitable an average price increase throughout the area of approximately 2d. per therm to meet the new level of operating costs. At the same time it resolved to send the Minister of Fuel and Power a strong protest against the severe increase in gas coal prices. There was, indeed, some body of opinion in favour of rejecting the proposals altogether—with the idea, perhaps, of seeing what happened then. Mr. Guard explained, however, that in such circumstances he could only appeal to the Minister to decide whether the proposals to balance the budget were justified. In the end more moderate counsel prevailed, and it was agreed to send the protest as stated.

This protest and a similar one from the Northern area are not the first Mr. Geoffrey Lloyd has received on this subject; they will certainly not be the last. It is to be hoped that other gas consultative councils (who themselves represent the public) will show the Minister how great is the volume of public opinion against a coal tariff so unduly weighted against consumers of gas and coke.

## *TARIFFS FOR BREAD BAKING*

WE trust the Southern Consultative Council will not take it amiss if we criticise it on a point of procedure. At its meeting at Bournemouth on December 5 it received a deputation from the Berks County Master Bakers' and Confectioners' Association appealing for special consideration in the matter of tariffs for bread baking. We reported the meeting in some detail, and when it was decided to hold an emergency meeting of the Council to review the whole question we not unnaturally expected to hear more of it. Nothing was heard, however, until we learnt, on enquiry, that the emergency meeting had been held *in camera*. While consultative councils have every right to meet in secret we think that when the matter is of importance to the industry as a whole it would be courteous to issue at least a short statement for publication to indicate the outcome. We can only hope that the Berks Master Bakers have been informed even if the Press have been overlooked.

## *'GASAIR' PLANT*

Two plants—one of French origin, the other from the United States—have been installed in connection with the Wales Gas Board's butane/air experiments at Whitland. We are now informed that the 'Gasair' plant was supplied by the Draketown International Corporation, 11, West 42nd Street, New York, 18, and that two further 'Gasair' plants have been ordered by area boards and are at present awaiting shipment from the United States. The Draketown International Corporation has on hand orders for the same type of plant for France and other European countries, and negotiations are reported to be well advanced with regard to the possibility of starting manufacture of plants in this country. The 'Mallet' plant, as mentioned last week, was supplied by the firm of Mallet, S.A., 10, Rue de Milan, Paris (9e), through W. C. Holmes & Co., Ltd., Huddersfield and London, who have secured the exclusive licence for 'Mallet' plants and who report that further installations are in manufacture for area boards, including Wales.

# Letter to the Editor

### THE 'R' RATIO

DEAR SIR,—Mr. Hopton's valuable paper on 'Developments in Oxide Purification Plants' and the discussion which followed it (*Journal* of January 30, p. 291) reveal once again the difficulty and confusion arising from the different forms in which the oxide/gas is expressed.

The 'R' number has come to be widely used, but it is clear that it is not universally known, and any author using it must explain it in the course of his article. In any case it is incomplete and must be accompanied by a statement of

the number of boxes in use, since the 'R' number relates to one box only. It has the disadvantage that the larger the amount of oxide in use, the smaller is the number.

Mr. Hopton himself, in his paper, seemed to realise some of the difficulties, since, although he used the same ratio, he preferred to call it 'The number of space volumes per hour.'

Fundamentally, there is no necessity for these difficulties, since all the various space/velocity formulæ are only complicated ways of expressing a single function, that of time, as the examination of the dimensions of any of them will show.

Mr. Hopton's preferred 'R' ratio, or 'number of space volumes per hour,' of 20, is nothing more than a time contact of 1/20 hour or 180 sec. When he says that other installations in the industry operate at rates of 40 or more space volumes per hour per box, he indicates that they have a time contact of 90 sec. or less. The concept of time contact needs no explanation to anyone and is quite clear. It is self evident that a time contact of 90 sec. means that the gas takes 90 sec. to pass through the oxide and is twice as fast as a time contact of 180 sec.

May I suggest that this idea of 'time contact,' expressed preferably in seconds, should replace the many different forms of this ratio at present in use, including the 'R' number, which, although it has been of considerable use in the past, is complicated and not universally understood. The 'R' number can readily be converted to time contact, in seconds, by dividing it into 3,600.

The above suggestion does not in any way represent a criticism of Mr. Hopton's paper, which is most useful both for the valuable information which it contains and the discussion which it provoked.

Yours faithfully,

R. J. S. THOMPSON,
Continental Representative,
W. C. Holmes & Co., Ltd.

9, Rue Pierre Sémard,
Paris, 9e.

February 15, 1952.

# Personal

**Dr. H. Roxbee Cox,** Chief Scientist of the Ministry of Fuel and Power, has been awarded the James Clayton Prize of the Institution of Mechanical Engineers for 1951, amounting to £1,550, for his contributions to engineering science and practice, particularly in the field of aeronautics, power generation, and fuel utilisation, communicated in part in his Thomas Hawksley lecture to the Institution last November.

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**Mr. C. Marley** and **Mr. J. S. Wilson** have been appointed to the Board of Glover & Main, Ltd. Mr. Marley joined Thomas Glover & Co., Ltd., in 1907 as an indentured apprentice in the engineering department. After completion of his apprenticeship he served with the Royal Flying Corps from 1914 to 1919 and, on his return was appointed Assistant Works Manager, R. & A. Main Ltd., Edmonton. In 1923 Mr. Marley became Works Manager, R. & A. Main, Ltd., Edmonton, and in 1944 was appointed to the Board. In 1950 he was elected Joint Managing Director with Mr. P. D. M. Aird. Mr. Wilson joined Thomas Glover & Co., Ltd., in 1901 as an indentured apprentice in the engineering department. He entered the meter department in 1907 and for some years was in control of the automatic machine shop before being appointed assistant to the Works Manager in 1920. In 1923 Mr. Wilson was appointed Manager of Thomas Glover & Company's branches, and became their Works Manager at Edmonton in 1934. He was appointed General Manager of Thomas Glover & Co., Ltd., in 1941, appointed to the Board of that Company in 1950, and elected Deputy Managing Director in 1951.

# Obituary

**Mr. Quertier Le Pelley,** Chairman of the Guernsey Gas Light Company and Lieutenant-Bailiff of Guernsey, has died at the age of 83. He was created an O.B.E. in the new Year Honours this year in recognition of public services in Guernsey.

# Diary

**Feb. 21.—Midland Juniors:** Half-day visit to Humber, Ltd., Coventry.

**Feb. 21.—London and Southern Juniors:** Visit to Thomas De La Rue & Co., Ltd., Cavendish Works, Wandsworth, 2.30 p.m.

**Feb. 21.—Institute of Sewage Purification (Metropolitan Division):** Paper by Philip Wedgwood (Eastern Gas Board), Friends House, Euston Road, London, 6.30 p.m.

**Feb. 22.—Wales G.C.C.:** Boardroom, Bute Terrace, Cardiff, 11 a.m.

**Feb. 23.—Manchester Juniors:** Annual Dinner. Manchester.

**Feb. 26.—London and Counties Coke Sales Circle:** 'Domestic Solid Fuel Appliances of Today,' D. K. Darby, B.SC., A.M.INST.F. (Ministry of Fuel and Power), Holborn Restaurant, 2.30 p.m.

**Feb. 28.—Society of Chemical Industry (Yorkshire Section):** Joint meeting with Leeds University Chemical Engineering Society: Hodsman Memorial Lecture, A. C. Monkhouse, B.SC., PH.D., F.R.I.C.

**Feb. 28.—North Thames G.C.C.:** Westminster City Hall, Charing Cross Road, 2.30 p.m.

**Feb. 28.—Eastern Section, I.G.E.:** Discussion on Report of Institution of Gas Engineers' Sub-Committee on Unaccounted-for Gas, introduced by Lieut.-Col. J. A. Gould, M.C., M.I.MECH.E., M.INST.GAS E. Town Hall, Peterborough, 2.30 p.m.

**Mar. 1.—Midland Juniors:** Annual Dinner, Imperial Hotel, Birmingham.

**Mar. 3-29.—Ideal Home Exhibition,** Olympia. Gas Council stand No. 67, Grand Hall.

**Mar. 4.—South Eastern G.C.C.:** Caxton Hall (Kent Room), Westminster. 2.15 p.m.

**Mar. 4.—East Midlands G.C.C.:** Victoria Station Hotel, Nottingham, 11.30 a.m.

**Mar. 4.—Midland Juniors:** 'The Equipment of Combustion Safeguard Equipment,' J. Price (Coventry). At Birmingham.

**Mar. 7.—London and Southern Juniors:** 'Twenty Years of Development in West Kent,' F. T. Buist (South Eastern). 178, Edgware Road, 6.30 p.m.

**Mar. 8.—Scottish Juniors:** Joint meeting of Eastern and Western Districts; paper by J. T. Haynes, Junior Vice-President, Institution of Gas Engineers. Glasgow, 3 p.m.

**Mar. 11-13.—Gas Service Conference.** Seymour Hall, W.1. (For full programme see p. 469.)

**Mar. 12.—London and Southern Juniors:** Visit to Lewis Berger works, Homerton. 2 p.m.

**Mar. 12.—Yorkshire Juniors:** President's Day. Visit to Drakes, Ltd., Halifax.

**Mar. 12.—South Western G.C.C.:** 34, Bridge Street, Taunton, 11 a.m.

**Mar. 13.—Manchester and Midland Juniors:** Joint visit to James Stott & Co., Ltd., Oldham.

**Mar. 14.—Scottish Juniors (Western):** Annual Dinner and Dance, Beresford Hotel, Glasgow.

**Mar. 15.—Wales and Western Juniors:** Joint meeting. 'Gas Masks, Resuscitation, and First Aid,' J. W. Green (Stroud). At Gloucester.

**Mar. 17.—Eastern G.C.C.:** Connaught Rooms, London, W.C.2, 2 p.m.

**Mar. 18.—Institute of Fuel:** 'Fuel, Heat, and Power Auditing,' L. Clegg, M.B.E., and J. Price Walters, B.SC. (TECH.); Institution of Mechanical Engineers, Storey's Gate, 5.30 p.m.

# BRITISH WOOD PRESERVING ASSOCIATION

STEADY progress, increased membership, and added support during 1951 were recorded at the annual general meeting of the British Wood Preserving Association at 21, College Hill, London, on February 13. The outstanding event of the year was the first convention at Gonville and Caius College, Cambridge, which was so successful that a second convention has been arranged to be held at Queen's College, Cambridge, from June 23 to 25 this year.

The annual report referred to valuable co-operation with the British Standards Institution in considering drafts of a number of standards relating to timber and preservation. From the beginning of 1952 Mr. H. A. Cox, for some years Secretary, took up the position of Technical Director, and following discussions with the Timber Development Association Mr. W. E. Bruce, M.A., took over the administrative and secretarial duties.

During 1951 new sub-committees were appointed to deal with membership and publicity and service records. The report says that 'with regard to the desirability of collecting service records there can be no division of opinion since in due course they will provide irrefutable performance data on the behaviour of various preservatives in different environments.' The Chairman of the Service Records Sub-Committee is Mr. R. G. Bennett, C.B., who until his retirement was Director of the Post Office Contracts Department and who is a member of the Forest Products Research Board.

Regret was expressed in the report at the resignation of Mr. S. Roberts from the position of Hon. Treasurer, but it was announced with some satisfaction that he had agreed to retain his Hon. Membership.

The British Railways Executive, the British Electricity Authority, the Gas Council, and 10 of the gas boards (the two exceptions being South Western and North Eastern) are members of the Association, and their representatives serve on the Council, the Executive Committee and various sub-committees. During the year numerous requests for advice were received from the War Office, Ministry of Education, Ministry of Works, and the Ministry of Health. Both the Ministry of Works and the Ministry of Supply were invited to nominate representatives to serve on the Service Records Sub-Committee; the B.E.A. and British Railways also agreed to send representatives.

After the adoption of the report, Major A. G. Saunders (Prince Regent Tar Co., Ltd.) was re-elected President, with Mr. H. E. Hickson (Hickson and Welch, Ltd.), Mr. Stanley Robinson (Midland Tar Distillers, Ltd.) and Mr. T. G. Robinson (Robinson, Dunn, & Co., Ltd.) as Vice-Presidents. Mr. Tom Brown (South Eastern Gas Board) was elected Hon. Treasurer in place of Mr. S. Roberts, and the appointments were confirmed of Mr. Cox as Technical Director and Mr. Bruce as Secretary.

For the Council seven members were nominated to represent tar and creosote interests as follows: L. A. Drapper (South Western Tar Distillers, Ltd.); L. W. Blundell (North Thames Gas Board); Commander C. Buist (Coalite and Chemical Products, Ltd.); J. B. Vickers (Yorkshire Tar Distillers, Ltd.); F. M. Potter (Scottish Tar Distillers, Ltd.); Major T. Knowles (Association of Tar Distillers); and C. E. Carey (British Tar Confederation).

# British Gas Staff Association

THE annual general meeting of the Bournemouth branch of the British Gas Staff Association was held on February 7.

In his address, the Chairman, Mr. H. T. Symons, appealed for a re-awakening of the spirit of brotherhood in industry and said that in his view some complete form of industrial co-partnership must come if we were to survive.

Mr. Symons thought that the provision of a pension scheme for new entrants since vesting day and for members of the staff who were not members of the old co-partnership pension schemes was long overdue and he could not understand why no information had been forthcoming from the gas boards.

He said that, however important the Association had been in the last few years, it was becoming increasingly evident that it would be more and more necessary in the years ahead.

Officers were elected as follows:—Chairman, H. T. Symons; vice-chairman, C. S. Gray; Hon. Secretary, W. Carter; Hon. Treasurer, R. G. Pickett; Publicity Officer, J. McGovern; Auditors, R. Daniels and E. G. Wellman; Committee, R. Cull (Rental), A. Rouse (Sundries), Mrs. Darby and G. Brooks (Prepayment), R. N. R. Hawkins and H. S. Witherington (Sales), C. Bartlett (Bourne Valley), Miss J. Diffey, S. G. Bishop and C. M. Pardy (Distribution), E. Clapp and G. Orbell (Poole and Pitwines Works), R. Wallingford (Costing Office), Mr. Thomas (Stores Office), E. M. Raven (District Inspectors), W. Bartlett (Pensioners), B. Blanchard and E. Rose (Western Division).

# Boring for Natural Gas

Imperial Chemical Industries, Ltd., have applied to the Whitby Rural District Council for permission to sink an exploratory borehole for natural gas, and later, if gas is found in sufficient quantities, to work the borehole as a production well.

According to the *Manchester Guardian* Fairhead Farm, Grosmont, where I.C.I. has acquired land, is thought to be the most likely to produce satisfactory results, and it is known that there is methane or natural gas in this part of Yorkshire. What is to be established is its presence in sufficient quantity and if some practical means can be devised of getting it to the surface and storing it as coal gas is stored.

Reports from Italy suggest these are practicable, and if they prove to be so in this case tremendous possibilities are opened up. Methane gas possesses nearly 40% more energy than coal gas and its use on a considerable scale would contribute enormously to a solution of the present fuel problems.

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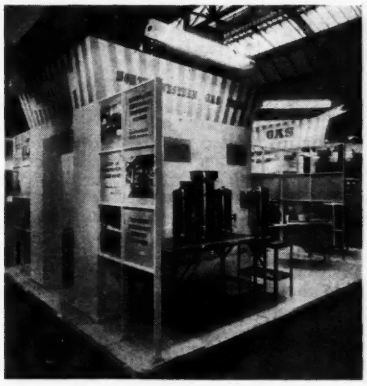
**The Grey Edition** of 'Distribution in the Western Area of the North Thames Gas Board,' by A. D. L. Copp (Communication No. 388/185) is now available from the Institution of Gas Engineers, 17, Grosvenor Crescent, S.W.1, price 2s. 6d. per copy, post free.

# GAS AT NATIONAL ICE CREAM EXHIBITION

FORMERLY British ice cream interests were represented at the Dairy Show, but this year the Ice Cream Alliance decided to hold an independent exhibition devoted solely to the ice cream industry. The exhibition was held at the City Hall, Manchester, from January 29 to February 2 and was well attended by people from all over the United Kingdom.




*The North Western Gas Board's stand at the Ice Cream Exhibition.*

The North Western Gas Board's stand featured various gas appliances associated with the manufacture or sale of ice cream. The appliances included a fully automatic gas-fired steam boiler, suitable for supplying all the requirements of a medium sized modern ice cream factory. In addition, direct heated gas appliances were also on view; these included representative samples of pasteurisers, sterilising chests, sterilising sinks and water heaters. To interest representatives of the retail side of the trade, who run milk bars, etc., there was a display of modern café sets and other hot water equipment.

The stand included many large photographs showing typical installations of gas equipment in ice cream factories and also gas heated machines and ovens in biscuit works to make ice cone and wafer biscuits.

Enquiries were received on the gas stand from many different parts of the country, including the areas covered by nine different gas boards.

Other exhibits at the show of interest to the gas industry included a Baker Perkins gas heated automatic wafer machine, which was displayed in use and producing wafers, a display of Victoria Arduino coffee machines and a Kay gas heated combined pasteuriser and cooler.

*CONSULTATIVE COUNCILS*

# Southern Council's Protest to Minister

HAVING heard from the Chairman of the Board (Mr. Owen R. Guard) details of proposed increases in the price of gas throughout the Southern Area, the Consultative Council resolved to send the Minister of Fuel and Power a strong protest against the severe increase in the cost of coal to the gas industry. The Council was holding a special meeting at the Board's chief office at Southampton on February 11, the Chairman (Alderman J. W. MOORE) presiding.

Mr. Guard referred at the outset to the new coal price structure introduced by the National Coal Board as from December 31, 1951, which, he observed, was based on a complicated formula modified by certain arbitrary factors and adjustments for commercial considerations which had not been disclosed. The effect of this was to throw a heavy burden on the gas industry, which, on the face of it, was out of all proportion to that placed on competitive industries. While it was appreciated that the additional cost of winning coal, arising from increased wages, holidays with pay, and the introduction of a pension scheme must be met, and every sympathy was felt for the worker who undertook the hazardous task of coal mining, Mr. Guard suggested that these additional costs should not have been imposed in such a manner until after the Ridley Committee had given further consideration to national fuel policy as a whole.

## Increased Costs

The delivered price of coal in the Southern Area as from January 1 had increased by amounts ranging from 4s. 9d. to 8s. 4d. per ton, the weighted average increase being 7s. 5d. per ton. The additional cost to the Board from this increase alone would amount to £517,000 per annum. There had also been increases in railway freights which it was estimated would cost the Board in a full year over £143,000. Moreover, higher charges for gas oil and for refractories and other materials would bring a further addition of approximately £160,000 per annum. The cost to the Board of the recent increases in wages and salaries, and the consequential increases in superannuation contributions, would amount to not less than £221,000 in a full year. Furthermore, approximately £128,000 would be required for depreciation in the next financial year, while the charge to the Board for interest would rise by some £99,000.

These additional expenses amounted to £1,268,000 in a full year, from which must be deducted an amount of £232,000 in respect of estimated additional revenue from coke, leaving a net deficiency of approximately £1,036,000.

Last year Mr. Guard had reported that since vesting day the annual increase of costs outside the control of the Board amounted to no less than £1,400,000. When the present increases in costs were added, to give a total of £2,436,000, they would realise the difficulties which the Board had had to meet since vesting day. In spite of all the economies made, the Board could not possibly meet the latest burdens—and, again, they had no alternative but to raise the price of gas.

At vesting day the Board took over some 63 undertakings, all with varying tariffs and prices. Schemes of integration had been pressed forward with all possible speed but the economic situation of the country, coupled with shortages of vital materials such as cast iron and steel, had sadly handicapped the execution of the Board's plans. Nevertheless, 12 works had been closed and linked with larger undertakings, six since April 1 last. It was difficult to see into the future, but the steel allocated to the area for 1952 was far short of requirements for even the most urgent work, and it was quite evident that it would not be possible to carry out all the schemes of integration which had been planned.

## Less Promotional

The average increase in gas price over the whole area necessary to cover the increased costs, continued Mr. Guard, was approximately 2d. per therm. The opportunity had been taken, however, to take a further step towards greater uniformity of prices throughout the area. Certain aspects of the tariff introduced last March could be held to be promotional, and in these days of shortages it was felt that the tariff should be modified to one of a less promotional nature. In maintaining its principle that gas should be charged for according to the quantity used, irrespective of the purpose of its use, the Board proposed to introduce progressive blocks. In the Eastern, Western, and Central Divisions it had been possible to standardise the steps so that the first 40 therms used in a quarter would be charged at the published price, and reductions would thereafter be made according to the quantity consumed. In the Northern Division, however, it was not possible to give a reduction until after the first 250 therms per quarter because the introduction of a step at 40 therms would necessitate raising the published price considerably higher than the increase now proposed—which would cause hardship to that large proportion of consumers whose consumption fell within the lowest group. In the Central Division, where the savings made possible by integration were particularly evident, it was proposed to have only two published prices—one for Reading and contiguous districts and the other for the rest of the Division.

It was suggested that these new tariffs should operate from the next meter reading after March 1, 1952. The effective increase in revenue would not be realised until some time after that date, and the additional costs from January 1 would have to be borne as far as possible out of current receipts.

In conclusion, Mr. Guard said he profoundly regretted that the Board had no alternative but to add to the burdens carried by the general body of the consuming public by an increase in the level of gas prices, but he thought he had shown that this was unavoidable.

A lengthy discussion followed Mr. Guard's statement, in the course of which the Chairman of the Board answered a number of questions from members. One was the amount of the surplus which the Board aimed to achieve at the end of the financial year, to which Mr. Guard replied that up to the third quarter they were running very well, but as a result of these additions they could only hope to break reasonably even. Asked whether the Board had made a strong protest to the National Coal Board, Mr. Guard observed that this had been done by the Gas Council.

The meeting found some considerable difficulty in framing a resolution suitably to cover their views on the Board's proposals. While the majority felt that the Board had no alternative there was clearly some strong feeling on the causes of the increase. A member asked what would be the effect of rejecting the proposals, to which Mr. Guard replied that he would then have to go to the Minister. If the latter upheld the Council, then as Chairman of the Board he would have to say that he could not balance the budget, and since it was obligatory under the Act to do so the Minister would be faced with appointing someone else who could.

## Discrimination

For a while the discussion developed along the lines of the differential price for coal in different parts of the country, with resulting discrimination against the south—it being pointed out that there was no difference in the wage rates as between one part of the country and another; and in addition to this there was the overall discrimination against the gas industry as a coal user.

The bulk of Council members agreed that the Board had no alternative to the proposals now before them and that no useful purpose would be served by rejecting them. Nevertheless, they felt that their views on the question of the N.C.B.'s discriminatory price should be brought to the Minister's notice. A resolution in the following terms was eventually framed and, on being put to the meeting, was carried by a large majority (17 to 3):

> 'While accepting the action of the Southern Gas Board in making provisions to balance their budget, we as a Consultative Council, desire a very strong protest to be sent to the Minister of Fuel and Power against the severe increase in the gas coal prices charged to the industry.'

Being a special meeting, there were no other items of business on the agenda.

(*Concluded at foot of p. 467*)

# Northern Council Alleges Discrimination

THE Northern Gas Consultative Council at its meeting at Newcastle on February 11, approved increases in gas charges for the area. It is the third (and in some divisions the fourth) rise in the area since vesting day. The average increase in charges is just below 2d. a therm—the biggest increase 2d., the lowest 1d. The effect will be to produce a net increase of revenue on all gas sold equivalent to about 1¼d. per therm or £750,000 in a full year. The broad structure of the tariff remains unaltered, but to minimise the need for special contracts and at the same time to relate charges more accurately to seasonal load-factor costs, the tariff has been modified somewhat in the large consumption range.

Where prices are relatively high, so that the effect upon sales of a price addition is likely to be more severe the addition proposed is somewhat less than the average. The new price ceiling will be 25d. per therm or 9s. 4½d. per 1,000 cu.ft.

The cost of supplying gas for street lighting increases in step with increased gas manufacturing costs, and is less affected by increases in other expenses of the Board. By increasing the street lighting discount (from 22½% to 25%) at the same time as public prices are increased the Board points out that a net addition sufficient only to meet the rise of manufacturing costs will be made to the charge for gas supplied for this purpose.

## Approval Under Protest

The Council approved the new price structure, but protested in a lengthy resolution against the discriminatory manner in which the increases in coal prices had been applied. While accepting the need of the National Coal Board to recoup its extra expenditure on miners' wages and conditions of employment, as well as on materials, the Council protested to the Minister of Fuel and Power against the arrangement whereby not only was the average additional cost per ton to the gas industry as a whole greater than that to any other class of user, but in addition the average additional cost per ton to the Northern Gas Board was greater than that to the gas industry as a whole.

The Council recorded its opinion that increases arising from such causes did not warrant such discrimination, and pointed out that, notwithstanding the explanation of the Coal Board that pithead prices were related to coal quality as determined by scientific analysis and commercial knowledge, coals of similar quality and characteristics were sold to different classes of users at different pit prices. Even within the gas coal market, the pit prices of coals of equal quality differed according to the coalfield from which they were obtained.

The Council considered that the inevitable increase in the prices of gas and coke could not fail to encourage the displacement in industrial use of these fuels by imported oil, to the detriment of the national economy, and their displacement in household use by means requiring a greater consumption of coal to effect the same service with a worsening of the country's already difficult fuel situation.

The Council considered therefore that its obligations under the Gas Act, 1948, constrained it to request the Minister to take such action as would lead to the cessation of discrimination against the gas industry in general and the Northern Gas Board in particular, and so mitigate the adverse effect of coal prices on gas consumers.

Alderman Joseph Hoy, Chairman of the Council, addressing members before welcoming Mr. E. Crowther, Chairman of the Board, to the meeting, said that the industry was having to face a series of heavy commitments thrust upon it by a combination of events outside its control.

## The Heaviest Burden

Mr. Crowther said it was a matter of the greatest concern to the gas industry and not merely to that Board that the price of coal to them should have been increased by more than the general increase in coal prices announced by the N.C.B. at the end of last year. The average pithead increase to the gas industry was 6s. 4d. per ton; to general industry, 4s. 1d.; to the electricity industry, 3s.; and to the household market, 5s.

It was evident that the industry had been asked to pay the highest increase in coal prices. The Gas Board had to publish price lists for all to see, and give the manner in which they were calculated and the principles on which they were based. There were no such requirements on the Coal Board. The only requirements were that it should market in accordance with national interest and avoid undue preference. They were not in a position to judge whether these obligations had been carried out adequately until they got further information.

They had protested to the N.C.B. about the new quality price formula, but at every turn they were hampered by lack of information.

Mr. Crowther said that since nationalisation coal prices had gone up by 30%; gas oil by almost 50% and wages and salaries by rather more than 20%. All materials and all services including railway and road transport followed the same upward trend. It was in these circumstances despite all economies—and they were quite considerable—that the gas industry had been unable to avoid an annual, or even more frequent, increase in charges. It was impossible for the Board to fight a one-man battle against inflation.

## Dearer Coke Oven Gas

Because of the superimposing of district differentials the Gas Board found itself confronted with an average pit price increase of 8s. 3d. per ton on its coals. Adding to this the effect of the recent 10% increase in railway freights, there was an additional sum of nearly £500,000 to be met on account of coals delivered to the Board, of which about 40% would be recovered through the parallel advance in coke prices.

An increase in coal price automatically brought in its train an increase in the price of coke oven gas: expenditure on coke oven gas would increase by about £200,000 per annum.

Other additions to the Board's expenses had been occasioned by national awards to manual workers and staffs, by increases in the price of gas oil and petrol, and by the ever-increasing cost of all materials required for repair and upkeep of plant and equipment.

Interest rates on borrowed money had increased also, so that the benefits from improved efficiency and larger sales made possible by new plant construction had barely sufficed to meet interest and depreciation charges on the new capital expended.

In total, the prospective financial position for 1952-53 might be summarised thus:—

| | £ |
|---|---|
| Extra cost of coal (delivered) and of coke oven gas, less improved by-product income ... ... ... ... | 500,000 |
| Extra cost of oil, petrol and materials of upkeep ... ... ... ... | 175,000 |
| Wages and salaries awards ... ... | 140,000 |
| | 815,000 |
| *Deduct* whole year's product of previous price increase, less proportion of same actually collected in 1951/52, and less estimated loss for that year ... ... | 200,000 |
| Net trading deficiency 1952/53 ... ... | 615,000 |

## A Wave of Inflation

To this figure must be added the amount of the estimated loss for 1951-52, which it would be necessary to liquidate, say £135,000, so that gas prices must be increased to produce an extra £750,000 per annum. This was a matter of great regret to the Board, not only because of its disappointment at seeing all its efforts towards economy and stability swept away by a wave of inflation which it was powerless to resist, but in addition it was apprehensive lest the new gas price levels should cause business to be lost, and the financial

(*Concluded from p. 466*)

One member did, however, ask whether consideration had been given to having gas and electricity meters read by one official with a view to effecting economy in staff. The Chairman of the Board stated that experiments were actually being carried out along these lines, but there were considerable complications which were not obvious at first thought, as a result of which the economies were nothing like what might be supposed.

In bringing the meeting to a close, Alderman Moore expressed the Council's appreciation of the presence of Mr. Guard, and also of Mr. S. E. Whitehead (Deputy Chairman), and Mr. T. E. D. Mason (Secretary of the Board) who accompanied him.

position to deteriorate in consequence. With the latter consideration in mind, the Board's proposals had been kept to the minimum safe level which would meet the situation.

The Board invited the views of the Consultative Council on a proposal to discontinue the purchase of 'pennies only' prepayment meters. The quantity of gas which 1d. bought was so small that this produced certain undesirable results where meters were constructed to take coppers.

It was proposed in future to obtain meters which would accept either shillings or sixpenny pieces. As for existing meters the mechanisms of the 'pennies only' meters would be replaced by 'sixpences only.' In the penny-shilling meters, the simplest operation would be to seal off the penny slot and thus convert them to 'shilling only.'

The Council accepted, but felt that special consideration should be given to old age pensioners, many of whom were often waiting anxiously for the next pension day. 'We are concerned about them in these days of ever-increasing prices, many of them are able to provide a copper coin before a silver one,' said Alderman Hoy.

It was agreed that the Board should be asked to give special consideration to their position when the schemes of reorganisation was undertaken.

## Compensation and Income Tax

AN important case was heard in the Queen's Bench Division on February 12 and 13, before the Lord Chief Justice sitting with Mr. Justice Parker and Mr. Justice Jones.

Mr. G. W. Denman, previously Works Superintendent at Swanage gasworks, had claimed compensation from the Southern Gas Board when he lost his occupation following the closing of the works. The British Gas Staff Association, acting on behalf of Mr. Denman, who had been unable to find similar employment in the gas industry in the British Isles and had therefore accepted a position as Works Engineer at Hamilton, New Zealand, claimed before the Reading Tribunal compensation based on his salary and on his emoluments which included a house, garage, gas, coke, electricity, etc., and also claimed that since he received emoluments free of tax liability, the value set upon those emoluments should include a sum to cover the tax he would have to pay on any compensation in respect of those emoluments.

The Tribunal, in assessing the compensation, had ruled that the appellant's freedom from liability to income tax in respect of the occupation of the house was not a privilege within the meaning of the regulations and that in assessing the money value of any accommodation, board, or other privilege, the income tax factor ought not to be taken into account.

The British Gas Staff Association, through its legal officers, then sought leave of the High Court for an order of certiorari for the purpose of quashing the Tribunal's decision.

The Court, having heard the case on behalf of the appellant, gave its ruling that the decision of the Tribunal was correct that there was no authority for taking into account the tax position when valuing emoluments for the assessment of compensation.

## I.G.E. Examinations

As Wednesday, May 7, 1952, the date selected for the Diploma and Higher Grade examinations in Gas Engineering (Manufacture) of the Institution of Gas Engineers, coincides with the date for the ancillary subjects examinations in Heat Engines S3 and Electrical Engineering S2 conducted by the Union of Educational Institutions, it has been decided to hold the examinations in Gas Engineering (Manufacture) on Tuesday, May 6. There will be no alteration to the date for the examinations in Gas Engineering (Supply), which will be held on Thursday, May 8.

**Liquid Fuels.**—A course of eight evening lectures on 'Liquid Fuels, their Properties and Utilisation,' will be delivered by Mr. G. F. J. Murray at the Northampton Polytechnic, St. John Street, London, E.C.1, on Tuesday evenings commencing February 26. The course will provide a survey of present-day knowledge, and the viewpoint of the uses of liquid fuels will be stressed throughout. The fee for the course is £1.

**Consequent on the Introduction** of an automatic system at the Cardiff telephone exchange, the following changes in telephone numbers should be noted: Wales Gas Board headquarters, 1 & 2, Windsor Place—Cardiff 28621 (6 lines); Wales Gas Board, technical headquarters, Grangetown, Cardiff—Cardiff 32164 (3 lines); Wales Gas Board, Cardiff undertaking—Cardiff 32511.

## Ideal Home Exhibition

EXAMPLES of the 'people's house,' with which the Government hopes to make inroads on the nation's waiting housing list, are to be shown at the Ideal Home Exhibition from March 4 to 29. An old people's bungalow, also presented by the Ministry of Housing, will also be shown and near-by will be other types of houses built by private enterprise and many fully stocked shops.

The people's houses will be presented as a semi-detached couple. In the two-bedroomed example, cooking will be done by gas, but the living room has an open fire with a boiler for water heating. In the three-bedroom home the tenant will cook by electricity, but a stove in the living room provides warmth and hot water supply.

Some of Britain's most experienced chefs are to take part in a demonstration which will provide not only some fun but many intriguing solutions to a domestic crisis. The audience in a quiet theatre will watch the drama of the young wife faced suddenly, after a telephone call, with the urgent need to produce a meal for four within half an hour—just when her pantry is all but bare.

Enter the chef. 'I'll show you what I would do,' he says, considers the resources and starts work with them. Most of the chefs taking part in their turn in this practical demonstration of how to make an attractive three-course meal out of so little time and material are members of the International Academy of Chefs de Cuisine. Many of them will come from famous hotels, clubs, and restaurants in London's West End. The title of their piece is 'Crisis in the Kitchen.'

## GAS FOR HOSPITAL BOARD HEADQUARTERS

LEEDS Regional Hospital Board has recently installed gas cookers in its headquarters at the Queen Hotel, Harrogate, under the Board's hire agreement for educational purposes.

These appliances have been installed to equip a model kitchen, which is part of a scheme of preliminary training for student nurses.

The students, men included, are taught practical and invalid cooking in this model kitchen, which is equipped with all the necessary modern utensils, four gas cookers and a large refrigerator. The school is to be conducted, in the words of Mrs. Elizabeth A. T. Sanderson, principal teacher, 'on fairly informal lines.'

*Some of the students in action.*

# GAS SERVICE CONFERENCE

IN consequence of the death of the King the programme for the Gas Service Conference on March 11, 12, and 13 has been modified. The Duke of Gloucester will be unable to open the conference, and the whole of the proposed Tuesday morning proceedings at Friends House has been cancelled, as also have been the civic reception on the Tuesday and the official luncheons on the Tuesday and Thursday, but the buffet luncheon for the Wednesday will be provided as arranged. All sessions will be held at Seymour Hall, W.1, and the main features of the revised programme are as follows:—

**Tuesday, March 11**

2 p.m.—Welcome by the Mayor of St. Marylebone; opening address by Colonel H. C. Smith, Chairman of the Gas Council. Consumer Service session presided over by Mr. T. Mervyn Jones, Chairman, Wales Gas Board; 'Gas and the Public Health,' Dr. E. K. Macdonald, Medical Officer of Health, Leicester; 'Service to the Consumer,' A. F. Hetherington, Central Divisional Manager, North Thames Gas Board.

**Wednesday, March 12**

10.15 a.m.—Marketing session presided over by Mr. G. le B. Diamond, Chairman, West Midlands Gas Board; 'Training of Salesmen,' D. R. Griffiths, Director, Incorporated Sales Managers' Association; 'Importance of Coke to the Gas Salesman,' F. S. Evans, Coke Manager, South Eastern Gas Board.

12.15.—Inspection of exhibition of gas appliances arranged by the Gas Council, followed by buffet luncheon at 1 p.m.

2 p.m.—Manufacturers and the Industry session presided over by Mr. E. Crowther, Chairman, Northern Gas Board; 'Some Problems of Appliance Manufacturers in Serving a Nationalised Industry,' Right Hon. R. Law, M.P., supported by F. A. Hooper (Radiation Ltd.), P. D. M. Aird (R. & A. Main, Ltd.), F. P. S. Stammers (Ascot Gas Water Heaters, Ltd.), and J. H. R. Homfray (Electrolux, Ltd.).

4 p.m.—Aspects of Home Service: 'Specialist Consumer Service,' Mrs. E. Murphy; 'Sales Aspects of Home Service,' Miss Mary Strong, Cumberland Sales Manager, Northern Gas Board; 'Publicising Home Service to the Consumer,' Mrs. Mair Jones, Chief Home Service Adviser, South Eastern Gas Board.

Evening.—Visit to Ideal Home Exhibition.

**Thursday, March 13**

10 a.m.—Consumer and Industry session presided over by Mr. Michael Milne-Watson, Chairman, North Thames Gas Board; 'Films in Industry,' F. A. Hoare, Chairman, Association of Specialised Film Producers; 'One Woman's Point of View,' Dame Vera Laughton Mathews; 'Area Boards and the National Picture,' D. P. Welman, Chairman, North Western Gas Board; 'The Conference in Retrospect,' H. F. H. Jones, Deputy Chairman, Gas Council.

12.5 p.m.—*Gas Service* National Competition introduced by Mr. Clifford A. King, Managing Director, Walter King, Ltd.; presentation of awards, Colonel H. C. Smith; 'The Gas Council's Competition for Gas Salesmen's Circles' introduced by Mr. R. J. Gregg, Publicity Manager.

A visit to Watson House exhibition and a private meeting of chairmen and secretaries of circles at 3 p.m. at Gas Industry House have been arranged for the afternoon.

## IN PARLIAMENT

APART from messages of condolence from the legislative bodies of other countries and motions for addresses of sympathy to the Queen, the Queen Mother, and Queen Mary, the business of the House on February 11 was confined to written answers to questions, a few of which concerned the gas and other fuel industries.

Mr. GERALD NABARRO (Kidderminster) asked the Minister of Fuel and Power what sums were expended for capital development in 1951, respectively, by the National Coal Board, the British Electricity Authority, and the Gas Council; and what sums for capital development have been authorised, respectively, to these three bodies during 1952.

Mr. GEOFFREY LLOYD, in reply to the first part of the question, stated that accurate figures cannot yet be given, but it was estimated that expenditure by the N.C.B. was approximately £30 mill., by the area gas boards £40 mill., and by the B.E.A. and area boards £140 mill. In regard to the second part of the question, Mr. Lloyd said it was difficult in present circumstances to forecast accurately future expenditure on capital development. The Chancellor of the Exchequer had indicated, however, in his recent statement on the financial and economic situation that the fuel and power industries are, so far as possible, to be protected this year from any cuts in capital investment, and he expected therefore that expenditure during 1952 would not vary very much from that in 1951.

## Capital Investment

### Powers of Entry

Miss IRENE WARD (Tynemouth) asked the Minister what action he proposed to take on the recommendation of the North Thames Consultative Council that the 1948 Gas Act should be amended to provide that a police officer must accompany any official sent to force entry into private premises. It will be recalled that Miss Ward asked a similar question towards the close of the last Session, at which time the Minister had only just received the recommendation.

Mr. LLOYD replied that although the provisions relating to forcible entry by officers of gas undertakings had remained virtually unchanged since 1871, he thought there might be grounds for their modification. He was examining the possibility of bringing these powers into line with more recent legislation.

### Departmental Responsibilities

Mr. LESLIE HALE (Oldham, West) asked the Minister what matters in relation to the production and distribution of coal, electricity, and gas, respectively, are now dealt with primarily by his Department and not by the boards of nationalised industry.

Mr. LLOYD said the primary responsibility for the production and distribution of these fuels rests on the boards concerned. But he was responsible, in pursuance of various Orders made under the Defence Regulations, for allocating supplies of coal in the national interest. His functions in relation to the boards of the nationalised industries are set out in the various nationalisation statutes.

## Bravery Rewarded

AWARDS to two employees of the North Thames Gas Board announced in the *London Gazette* Supplement on February 12 were among the last to be approved by the late King. The British Empire Medal was awarded to Herbert Carbines, acting assistant foreman of mainlayers at Beckton, and the King's Commendation for Brave Conduct was awarded to William Lake, mainlayer's labourer, both resulting from an incident at Beckton works on October 4, 1951.

An excavation had been dug to expose gas mains in a main road and about a dozen men were working in or near it. Molten lead was being run in when there was an explosion, apparently inside the gas main, and the excavation became filled with dust and smoke. Carbines, who realised that a large escape of gas was possible following the explosion, immediately went into the excavation to rescue any of his workmates who might have been injured. He called to others to follow him and got down on his hands and knees to search for casualties.

He was unable to see anyone and as he passed the open mouth of a pipe he could smell gas coming out in great volume. He told the other men to go back but before they were all clear the gas ignited and the whole excavation became enveloped in flames. Carbines acted promptly and courageously without thought of self.

Lake's award was officially described as 'for services when an explosion occurred at a gasworks.'

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**Nearly 6,000 Children** have been entertained at 28 children's parties staged during the past month by social and sports clubs affiliated to the North Thames Gas Sports Association—and there are more parties to come.

# AMERICAN SPOTLIGHT

## *Items of Topical Interest from the Contemporary Technical Press of Canada and the United States*

### *COOKER INNOVATION*

A GAS range featuring an extra-table-top storage cart, has been introduced by Cribben & Sexton Co., Chicago. It will be available about March 1. The 'Wheel-About' kitchen cart is the new innovation on the 'Marlboro.' Where last year's 'Marlboro' had the conventional two service drawers, the '52 model features the cart which glides into and out of the range for use anywhere in the kitchen. The cutting board table top is firmly set into a recessed white enamelled top but can be easily removed for washing.

In place, with its front panel of porcelain finished in white enamel, the cart looks just as it should—part of the range. The 'Wheel-About' has a drawer on its side and under the top working surface. Overall width of the 'Marlboro' is 40 in. It also features a divided cooking surface with a 17 in. oven and a 17 in. broiler. (*Gas Age.*)

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### *CANADA IMPORTS GAS*

THE biggest pipeline job in Eastern Canada has been completed. Sixty-one miles of 16-in. steel pipe have crossed road, railway, creek, and river to give Union Gas Company much needed capacity for the importation of U.S. gas and improve winter delivery to its customers.

The $2\frac{1}{4}$ mill. line runs from the company's plant on the southern limits of Windsor to its underground storage station in Dawn township, Lambton county. The line was planned in 1947 when Union Gas Company completed its importation lines under the Detroit River, connecting its system with that of the Panhandle Eastern Pipe Line Company. Now, months and years of planning and building have been completed, and gas at the rate of 30 mill. cu.ft. a day can be passed through the new line.

The export permit allows no delivery at all in the winter period of November through March. As a result, company operations are based upon storing gas in the summer against high winter demands. Under these conditions the company was able to import only a limited amount daily through its existing lines. The average during the past two summers has been about 15 mill. cu.ft. per day. It will be possible to increase this volume by stepping up pressures. (*Canadian Gas Journal.*)

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### *UNDERGROUND GASIFICATION*

FOUR years of extensive experiments conducted by the Bureau of Mines at Gorgas, Ala., have shown that gases suitable for driving gas turbines and generating steam can be obtained through underground gasification, Secretary of the Interior Oscar L. Chapman announced in making public the second detailed report on the project. Further tests may prove the feasibility of producing gases for conversion to synthetic liquid fuels or chemicals, he said.

During 22 months continuous operation a total of 10,485 tons of coal, underlying an area of 83,690 sq. ft.—or almost two acres—was gasified. Over a four-month period when 65% of the heating value of the coal consumed in one area was realised, the energy yield was greater than could have been obtained from the coal mineable from the same area under existing mining methods. During one eight-hour period, combustible gas with a heating value of 90 B.Th.U. per cu.ft. was produced at a rate of 9.4 mill. cu.ft. a day. In other phases of the experiment when new inlets and outlets were driven near the burning coal faces, gases of 75 to 150 B.Th.U. were produced.

Further experiments are to be staged at Gorgas, the report revealed. A new installation is being constructed which features a series of electrodes for passing electrical current through the coal seam to open passages for air and gases. The proposed bed to be tested covers a larger area with resultant greater distances between outcrops and it is expected that the new system will reduce leakage which hampered both previous experiments. The new electrical system reduces site development costs and virtually eliminates all underground labour. (*Gas Age.*)

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### *LARGE SCALE REFRIGERATION*

DEVELOPMENT of a new refrigeration unit which may become one of the major factors in building gas loads was announced at the Servel, Inc., first air conditioning conference held at Chicago.

John K. Knighton, vice president in charge of sales, described an assembly plan for combining multiples of cooling units into heavy-duty air conditioning systems. Developed by the company's laboratories, the plan calls for combinations of from 2 to 40 or more of the units to provide equipment for large air cooling requirements.

The plan operates on the extreme flexibility of the absorption refrigeration unit. This is a direct expansion unit which uses water as a refrigerant in a hermetically sealed system. Steam from a gas-operated generator circulates the refrigerant in the cooling system. The unit has no motor, compressor, or moving parts.

John A. Gilbreath, assistant vice-president in charge of air conditioning, disclosed some applications of the company's 25-ton water chiller, which has been in operation less than a year. Deep secrecy surrounds some of the uses of the unit, Mr. Gilbreath said. Several companies have refused to reveal how they intend to use the 25-ton units in their processing, he added. (*Gas Age.*)

### *CANADA'S FIRST WIGGINS*

THE first Wiggins gasholder to be put into commission in Canada for the storage of coke oven gas is at the new blast furnace and coke oven plant of Dominion Foundries and Steel, Ltd., at Hamilton, Ontario. It is of $\frac{1}{4}$ mill. cu.ft. capacity and was built by Toronto Iron Works, Ltd. Other Wiggins holders storing industrial and chemical gas have, of course, been in successful operation in Canada for some time. (*Canadian Gas Journal.*)

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### *FIRE!*

ONCE again gas and appliances have established an excellent record in the files of the National Fire Protection Association. Each year this association compiles reports from state fire marshals and lists the numbers and losses from fires according to their causes.

The latest available data are for the year 1950, and they show gas and appliances far down on the list of causes—standing 21st on the tabulation of 25. This is an answer to highly competitive claims frequently made by those who would cast doubt on the safety of gas and appliances.

First on the list of fire causes is smoking and matches, to which were attributed 93,000 fires involving losses amounting to $55 mill. Second came electrical, fixed services, misuse, faulty wiring and equipment, causing 53,700 fires and losses totalling $73 mill. Gas and gas appliances caused 7,800 fires with total losses of $9 mill. (*Gas Age.*)

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### *PAR PLAN IN ACTION*

REPORTING on last year's—the seventh full year's—operation of the PAR (Promotion, Advertising, Research) Plan, Norman B. Bertolette, chairman of this particular A.G.A. committee, reveals expenditure of $1.6 mill., of which $600,000 was spent on research, $340,000 on promotion, and $813,000 on national advertising. The last-named reached 240 mill. subscribers through 341 insertions in 35 consumer magazines and business papers. Mr. Bertolette observes: 'The future is bright as research of today pays tomorrow's dividends.'

An interesting point was made of the work of the 'Hollywood Bureau,' which since its inception in 1945 has been able to place over 900 gas appliances in approximately 500 feature motion pictures, television films, and commercial shorts. In spite of the efforts of electrical manufacturers, the bureau is supplying gas equipment for over 90% of the motion pictures where kitchen scenes are shown. (*Gas Age.*)

# Health of Workers in the Gas Industry

By Dr. FRANK H. TYRER, M.A., M.R.C.S., L.R.C.P., D.I.H.,
Medical Officer to the West Midlands Gas Board.

**Abstracted from the *Journal for Industrial Nurses*: University of Manchester.**

THE City of Birmingham Gas Department, which was the largest municipally owned undertaking in the world, had for many years possessed a well-organised rescue, fire and ambulance brigade with over 100 members, nine of whom were full-time surgery attendants at the time the undertaking was nationalised. The services of a consultant had been called upon for certain examinations for some years, and in 1948 a full-time medical officer had been appointed, followed by the appointment of two State registered nurses six months later.

Elsewhere in the area medical supervision was limited to periodical skin inspections of tar workers, in a minority of undertakings, and routine medical examinations as a preliminary to admission to sick pay and superannuation schemes—carried out either by a local practitioner or (in some municipal undertakings) by the staff of the medical officer of health. Works first-aid organisations were active in one or two districts, but non-existent in many.

## Industrial Medical Officer

Some months after nationalisation the post of medical officer became vacant, and the Board decided to appoint an Industrial Medical Officer to organise a health service for the whole area. This appointment was made early in 1950. After a preliminary survey of the area had been made, it was agreed that the following should be the functions of the medical services:—

Pre-employment or pre-placement examinations, so far as local circumstances permitted.

Examination before admission to sick pay and superannuation schemes.

Periodical skin inspections of tar workers.

Periodical examinations of workers exposed to other special hazards—*e.g.*, pneumoconiosis.

Follow-up of accident and long term sickness cases.

Advice to managements on working conditions, including the carrying out of environmental surveys.

Advice to individual workers, involving availability for consultation at fixed times.

The organisation and training of works first-aid organisations.

Treatment of accidents, dermatitis, and minor disabilities, so far as reasonably possible while the employee remained at work.

The last of these was obviously only realisable in the larger centres which possessed adequate premises and trained personnel, but the others are practicable even in small works.

At the outset it was clear that the scattered nature of the industry would necessitate some use of part-time medical officers, particularly in the country districts. After consultation with the local managements, visits were paid to general practitioners in a number of districts—usually those who had done some work for the undertaking before nationalisation, or failing this, the appointed factory doctor or someone suggested by him. Terms of service were agreed upon which embraced the conception of providing a *service* for employees, and taking an active interest in environmental factors. In some cases it was found possible to group two or more small undertakings in neighbouring towns under one medical officer, and in two instances, fortunately, general practitioners with special interest in industrial health were found, who accepted responsibility for whole divisions.

In Birmingham and the densely populated surrounding area, there was enough work for a whole-time Assistant Medical Officer and this appointment was ultimately made.

## Nursing Staff

As a general guide to staffing, the principle was adopted that a State registered nurse should be appointed to each works employing more than 500 people, and to each group of undertakings within a 10-mile radius where the aggregate of employees exceeded this figure. Following this rule, an additional State registered nurse was appointed in Birmingham, bringing the total up to three, and similar appointments were made in the three largest divisions outside Birmingham. All these nurses hold the Industrial Nursing Certificate, and the posts are supervisory and mobile. Each divisional sister has her base at the largest works in her division, and is responsible for supervision of the equipment and personnel of the surgeries at other works in the division. Steps have been taken to ensure that each has adequate auxiliary nursing personnel, either State enrolled assistant nurses or male full-time surgery attendants.

## First-Aid Organisation

It was common to find a few men in each works who had in the past been active members of a St. John or Red Cross organisation, but whose interest had since lapsed. Often this was explicable by the fact that no financial recognition of a first-aid qualification was made by the undertaking, and in some cases the volunteers had suffered loss of wages for time taken off work for lectures and practices. This situation was remedied by a Board decision to pay 5s. per week to men acquiring a First-Aid Certificate and 7s. 6d. to those holding a St. John Medallion or other approved qualification. Provision was also made for payment at overtime rates for time spent in training outside working hours, and for additional weekly payments to men proficient in fire-fighting and rescue work.

This step went a long way to reviving enthusiasm where it had flagged, and before long most undertakings had secured an adequate complement of volunteers for training. Training was usually undertaken by the local St. John or Red Cross organisation, sometimes in special classes at the works, but more often at the general courses held in the town. It was found necessary to supplement the latter by additional instruction in the use of Salvus breathing apparatus and Novox resuscitation equipment.

A further stimulus was given to interest in the subject by the organisation of an area competition to select a representative team to compete against other areas for a trophy given by the St. John Ambulance Association for the gas industry. Film shows on first-aid subjects were also arranged from time to time in a number of centres.

For the guidance of district managers, a standard list of minimum equipment in breathing and resuscitation apparatus in works of varying sizes was drawn up and circulated.

## Works Surgeries

In no unit has it been felt necessary to advise elaborate or costly new buildings, whose provision would in any case not have been practicable in present-day circumstances. The general aim has been to provide some kind of surgery or ambulance room in all establishments employing more than 100 people, and by October, 1951, this has been approximately 80% achieved. Usually an existing building has been available which has been adequate after minor internal alterations. As a rule, the surgeries are used by the medical officers for their regular clinics, whose frequency ranges from twice a week to once a month, according to the size of the works; they are visited by the sister at more frequent intervals. Two rooms are desirable so as to allow complete privacy for the medical officer's consultations and examinations. This has been achieved in a few cases by building a small extension, and in others by the erection of a glass-and-wood or hardboard partition, or, in the smallest works, by a curtain. In some undertakings, wooden huts have been erected and found quite adequate.

The equipment, so far as instruments and drugs are concerned, varies so widely according to the size of the works and the frequency of the sister's and doctor's visits that no attempt can be made to summarise it here.

In October, 1951, 24 of these centres were functioning, of which 18 are outside the Birmingham area. Regular clinics are held at 20. Five more centres will be opened in coming months.

The following is a list of potential hazards:

*Poisoning by Fumes and Gases.*—Carbon monoxide, ammonia, sulphuretted hydrogen.

*Tar Dermatoses.*—These include tar warts, of which the majority are benign and regress spontaneously, but of which a minority may develop into epitheliomata; folliculitis and tar acne; and the classical 'shagreen skin' of the textbooks. In addition, non-specific dermatoses, due to the combined effects of heat, coal-dust, friction, and detergents used in washing, are occasionally encountered.

*Pneumoconiosis.*—Silicosis occasionally occurs in men who have for years been employed on retort setting, demolition, and maintenance. The incidence of dust pneumoconiosis from coal and coke is still unknown, and this is a field for future investigation, but there is at present no evidence that it is high.

*Other Respiratory Diseases.*—There is some evidence to suggest that there is a higher incidence of bronchitis in gasworkers than in the general population, and the Registrar-General's Decennial Supplement for 1931 (the last year for which figures are available) shows that the occupational mortality rate from cancer of all sites is significantly high (151), and so is that from cancer of the lung and larynx (23 deaths as against seven calculated—age 45 upwards). This is another field for future research.

*Electric Shock.*

*Occupational Cataract.*—In men doing repair work on hot retorts.

*Heat Cramp and Heat Stroke.*

As in so many other industries, preventive health measures are directed principally towards securing dust suppression, adequate ventilation, and washing facilities. The first two of these are primarily engineering problems, and are kept constantly in mind when new plant is installed. As would be expected, working conditions are worst in those works where, owing to war and other conditions, old plant has had to be retained in use long after it would normally have been replaced. The contrast between the working environment in such a works and one containing a brand-new installation is striking and the latter provides some incentive to the men to keep it clean and tidy.

# GLASGOW'S RECORD OUTPUT

DURING the recent cold spell the output of gas at Glasgow was higher than ever before. The quantity produced was the maximum obtainable in present circumstances from existing plant. A higher efficiency in terms of volume and thermal value would require an improvement in the grade of gas-making coals, but these are not available in adequate quantity.

Plans are under consideration for new plant and distribution changes to link up neighbouring gas undertakings. These are calculated to take care of peak demands without loss of pressure. Some of the projects are of a long-term nature, but a three-unit water-gas plant at present in course of erection at Dawsholm gasworks may be completed in time to render help next winter. The contribution from this is expected to be about 7.5 mill. cu.ft. a day, or 15% of the daily average of around 45 mill. cu.ft. made during the cold spell.

This will be the first plant of its kind to operate at Dawsholm for at least 50 years, although such plant is in existence at Provan, Tradeston, and elsewhere.

The demand for gas soared in Glasgow during the cold weather in January. Abnormal demand made it impossible for works to follow their customary practice of building up supplies at the week-end by replenishing the holders ready for a good start on the Monday morning when the industrial load came on. Because of the low temperatures and the resulting domestic demand the consumption of gas at the week-ends was about 80% of the normal daily average.

So far as coal supplies were concerned, gas-making operations continued to suffer from quality below the standard needed for most efficient results. With the gradual exhaustion of the Lanarkshire coals a larger proportion of Fife and Lothian coals is having to be used. These are generally inferior to the old Lanarkshire gas coals, which are among the best to be found anywhere. Those from the eastern coalfields are of good quality in many respects, but they are not so suitable for gas-making.

Some of the best coals for this purpose are those from the Kingshill district in Lanarkshire. Development of Kingshill No. 3 Colliery, where production is expected to begin very shortly, will help to replace some of the tonnage lost from exhaustion of other pits. There are prospects, too, that the new colliery under construction at Kinneil, West Lothian, will provide good quality coking coals, similar to those from Blairhall on the north of the Forth.

A satisfactory feature of the recent heavy demand for gas was that coal stocks at gasworks stood the strain well.

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**An Exhibition** of modern Swedish architecture will be held at the Building Centre from March 1 to 29. In connection with the exhibition a lecture will be given on March 6 at 6 p.m. at the Royal Institute of British Architects by Professor Paul Hedqvist of Stockholm.

## Dust Gasification

The Power-Gas Corporation, Ltd., of Stockton-on-Tees, has acquired the United Kingdom and Commonwealth rights covering the Panindco coal dust gasification process of Compagnie Pan-Européenne d'Installations et d'Equipement Industriels, Paris.

The process has been developed following experience of coal dust gasification gained with the Schmalfeldt plants in Germany and employs the principle of gasification by entrainment in preheated steam, air and oxygen. It is especially suited for dealing with reactive low grade fuels and can be operated to provide various types of gas, particularly synthesis gas where a low hydrocarbon content is required. A demonstration plant has been built in France and is used for preliminary trials on various fuels to establish design data for industrial projects.

# PUBLICATIONS RECEIVED

The Australian Gas Institute is to be congratulated on the standard and the promptitude of its *Transactions*. The volume covering 1950 just to hand—a substantial work of 274 pages—contains full reports of the annual general meeting and conference and of the separate meetings of the Southern and Northern Sections. The index shows that 66 speakers took part in the debates, some of them speaking as many as a dozen times on different topics. In addition to the Presidential Address of Mr. J. E. Logan, Sales Manager of the Australian Gas Light Company, of which we have already published a summary, there were papers at the annual meeting on 'Policy Regarding Servicing of Consumers' Appliances and Requirements of an Efficient Servicing Organisation,' by E. F. Magee, 'Technical and Economic Consequences of a Leakage from a Distribution System,' by R. H. Maher, 'Refractory Materials in Gas Making Plant,' by T. M. Firkin, and 'Selection of Foremen and Other Supervisory Officers,' by H. F. Benning. The Section discussed such varied topics as horizontal retort settings, water heaters and water heating, high pressure distribution, and 'Religion and Industrial Relations.'

In the *Journal* of July 4, 1951 (p. 50), we reported in brief the contributions of the coal carbonising and tar distilling industries to the first annual convention of the British Wood Preserving Association, held at Cambridge during the preceding week. The papers in which the tar producing and distilling industries were interested represented only a part of a comprehensive programme covering every aspect of wood preservation in this country and overseas. The Association has now issued a complete *Record of the Convention* comprising some 196 pages and covering all the papers presented and the discussions which they provoked. It should prove a welcome and valuable addition to the literature on wood preservation, of interest both to the timber using trades and to the chemical and other industries responsible for producing the necessary preservatives. The British Wood Preserving Association has been in existence since 1930, but its activities were curtailed during the war period. After the war reorganisation was considered necessary and this was undertaken in 1949 under revised articles of association. The President is Major A. G. Saunders, of the Prince Regent Tar Co., Ltd.

# Gas Industry in France

—By ASHTON

## A selection from the French Technical Press

IN October the Governor General of Algeria formally inaugurated the new gasworks at Oran which had been completed and put into operation in March last. The Editor of the *Journal des Usines à Gaz*, promising a detailed description, remarks that this will be the smallest gasworks based on the coke oven. The ovens are equipped for compound heating with mechanical producers and supplemented by water gas. This works is part of the plan for the modernisation and equipment of North Africa. It is proposed to build a coke plant outside Algiers itself —that is to say, in the centre of gravity of Algerian industry—to improve existing gasworks, that at Alger-Hamma, for instance, will be equipped with water gas plant and the existing horizontal retorts will be demolished, and finally the installation of transmission mains connecting Algiers with Blidah and Bône with Philippeville with the suppression of the old works at Blidah and Philippeville.

Algiers is developing rapidly, with repercussions on the consumption of gas which is growing annually at the rate of 5% to 6%. Production increased from about 2,540 mill. cu.ft. in 1949 to 2,650 mill. in 1950, while it was only some 1,837 mill. at the outbreak of war.

### Architecture of the Gasworks

The November issue of the *Journal des Usines à Gaz* carries the third instalment of M. Combet's notes on the architecture of the gasworks. M. Combet is the Directeur-Général of Gaz de France. His treatment of the subject is not unlike that of M. Veillon. This instalment deals with the general plan of the works. Few gasworks or coke oven plants stand up victoriously to criticism. If one had to do it again one would have arranged the several items differently —one could not foresee everything—but such imperfections may prove costly. Is it possible to avoid them? M. Combet seeks to enunciate the general principles of design. The two main principles are (1) that the works should be so designed as to secure from the outset the lowest cost of manufacture, (2) that this condition may continue in the future as far as possible in spite of the modifications which may become necessary. He discusses these at considerable length. In general, industrial plants can be planned in parallel ranges, since they comprise a series of workshops between the stock of raw materials and that of finished products or residuals. These stocks and workshops need to be connected by a system of circulation which should be as simple as possible. It is important that the plant should be capable of development without complicating or impeding this circulation system. The general plan should be designed on two main lines: The 'axis of manufacture,' a line parallel to which the principal raw material passes from stock through the successive stages of fabrication, and the 'axis of extension,' parallel to which each section of plant can be extended. It is essential that this second axis should define the circulation of by-products and waste products and all other accessory circulations. Applying these general principles to the gasworks it is pointed out that the position of the storage grounds for coal and coke always play an important rôle in fixing the general arrangement of the works. They can be placed in the same region, towards the longer side of the site to simplify the arrangement of rail tracks, to facilitate weighing, to enable the two areas to be interchanged in use as may be necessary. The use of scale models in design is recommended and the necessity for full consultation at this early stage with all interested parties is again emphasised. It is never loss of time to study deeply and thoroughly the fundamental plan which will determine the destiny of the works both in the immediate and the distant future.

### New Coke Ovens at Moyeuvre

The first section of the reconstructed coke oven plant of the Ste. de Wendel et Cie at Moyeuvre has been completed by the Cie. Gle de Construction de Fours. It comprises a battery of 44 ovens with machinery, a coal tower connected with existing coal handling plant, complete coke handling and screening plant, and plant for the preliminary treatment of ammoniacal liquor connected with the existing plant for the treatment of by-products, all designed to deal with 88 ovens. The existing coke oven plant is very old and practically at the end of its useful life. Ultimately it is proposed to construct a second battery of 44 ovens, a new plant for the handling and preparation of coal, and a new plant for the treatment of by-products.

The water level in the substrata lies at 1.35 m. below the works ground level. To obviate pumping and shoring which would have been necessary to construct deep concrete beds, structures of considerable weight (coke bench, coal tower, chimney, and discharging bank) are carried on concrete piles connected by ferro-concrete capping supporting the superstructures. The corrosive nature of the ground water, charged with tar and oil, led to the preference of precast piles driven to refusal and cut off at ground level. Lighter loads are carried on simple foundations on the natural soil. Underground constructions are made water-tight to the level of high water by an asphaltic internal lining.

The coke ovens, in one battery of 44 ovens divided into two blocks of 22 by an intermediate space, are of the Koppers circulation type with differential heating, constructed partly in silica and partly in silico-alumina on the principle called 'free expansion.' They are designed for compound heating and can be heated either by oven gas or by blast furnace gas. They are very large; height 4.250 m., length 13.180, width 0.400, horizontal taper 50 mm., equivalent to about 14 ft. by 43 ft. by 16 in. wide, taper 2 in. The capacity is about 15 metric tons of coke per oven per day or 660 tonnes for the battery. The normal carbonising period is 18 hours, although this can be reduced to 16 hours. With the 18-hour period there are 58 discharges per 24 hours, with an interval between two consecutive discharges of 25 min.

The heating system is described in considerable detail. (The Koppers circulation system of heating is that installed at Beckton). It is a system in which twin flues are used between the ovens; hot gases from the base of the downtake flue are added to the burning gases in the uptake flue to lengthen the flame. Differential heating is an adjustable arrangement of the heating of the free space at the top of the charge to obtain the optimum yield of aromatic hydrocarbons. The batteries, their construction and bracing, and the arrangements and details of regeneration, oven control, and regulation are very fully described.

Charging and discharging and the transport of coke to the quenching tower then to the loading bay are effected by machinery of robust and modern construction designed to serve not only the existing battery but the identical one ultimately to be erected—an eventual 116 chargings and dischargings per 24 hours. The coal car, discharging machine, coke bank, and coke car with its tractor are described in detail.

The 'coal tower' with bunker capacity of 4,000 tonnes corresponding to a little more than two days supply to the two batteries of 44 ovens is the biggest in France and one of the biggest in Europe. It is sited between the ultimate two installations. Coal is brought to the tower on a belt conveyor from an existing coal tower; it will ultimately be supplied from a new coal breaking plant. Coal is mechanically distributed over the full area of the bunkers. It is fed to the coal car through valves in four lines. The car passes over a double recording weighbridge before leaving the tower. Provision is made for the installation of a second weighbridge when the battery of ovens is duplicated.

Coke is quenched in a coke car under the quenching tower. It is discharged on to an inclined bank from which it passes to a conveyor band. A system of band conveyors to three points permits the storing of 600 tonnes of run-of-oven coke in a bunker, the charging of screened large coke over 60 mm. either in sheds for the blast furnaces or direct to railway wagons, and to stock 600 tonnes of small coke in four sizes to be fed

to rail or road transport. The first named bunker is not normally used; large coke after screening is taken direct to its destination keeping a reserve so that the screens are not stopped. The whole of this plant is designed to minimise the fall of coke.

The separation of the large coke is effected by a vibrating screen by the Cie. Continentale des Compteurs, consisting of a metallic meshed screen cloth supported in a steel frame at 18° inclination resting on four helicoidal springs. The table of the screen is 3.70 m. long by 1.50 m. wide (say 12 ft. by 5 ft.); it is vibrated by an eccentric shaft at 1,000 oscillations per minute and has a normal capacity of 100 tonnes per hour. It is provided with a duplicate in reserve. Small coke is graded in resonance screens. Tar and liquor are separated in a settling tank and pumped separately to the by-product plant for treatment.

Coals carbonised are a mixture of 63% Ruhr, 27% Sarre, and 10% Roselle on the average, with 23.5% volatiles, 6.9% ash on the dry basis, and 10% moisture. They yield a coke with about 9% ash. Gas is obtained at the rate per tonne of 320 cu. m. at 4.500 calories (say per ton 11,500 cu.ft. at 470 B.Th.U.). On test, fuel consumption was 480.000 calories per tonne with oven gas and 514,000 with blast furnace gas. The average combustion chamber temperature was 1,300°C.

## Submarine Mains

The November issue contains interesting details of a set of three high pressure 4 in. mains laid across the estuary of the Scheldt up-stream from Antwerp in a bottom of highly saline mud and sand for a distance of 2.3 kilometres (say 1.4 miles). The mains are steel Mannesmann tubes ¼ in. thick. The joints are electrically welded of the Irak type. Particular care was taken with the protective covering in view of the corrosive nature of the surroundings. It consists of a primary coat of asphalt after cleaning in hydrochloric and phosphoric acid, a plastic coat 3 mm. thick of bitumen impregnated with 20% asbestos dust, a layer of glass cloth impregnated with hot asphalt about 1.5 mm. thick, another layer of plastic, a wrapping of asbestos carton impregnated with asphalt 1 mm. thick, a third layer of the plastic, another wrapping of the impregnated asbestos, a fourth layer of the plastic, and a final paint of lime wash, a total thickness of 12.5 mm. This covering was tested in the bed of the Scheldt on a trial length of main for several weeks before adoption.

On the whole submerged length the mains are packed in pine laths laid round the circumference. The laths are 3 to 4 cm. wide, 1.5 to 2 cm. thick, and 4 m. long. They overlap at the ends and are kept in place either by twisted steel wire or by flexible steel strips machine clamped. All submerged welds were tested by means of a radioactive isotope. A radio emitter situated on the bank enables the quality of joints and covering to be kept under observation. The operation of laying the mains, which is described at some length, was completed in a little more than one month.

## Bottled Gas

Although the number of gas cylinders used on vehicles or in stock in use since 1939 is considerable, from 250,000 to 300,000, the number of accidents has been relatively low. Of the cylinders used in service, excluding those opened under control, from 1930 to 1950, accidents in connection with vehicles numbered 77 breakages of steel cylinders, 15 of light alloys, and three in cylinders of large capacity. There were few injuries to the person but material damage was always considerable. A summary is given in this issue of the legislation relating to bottled gas and responsibilities in case of accident.

## Gas in the Ceramic Industry

In the December issue of the *Journal des Usines à Gaz*, M. R. Prévot, of the industrial physics side of the Research Department of Gaz de France, describes two intermittent muffle gas-fired furnaces for use in the ceramics industry in the region of Cannes. The goods made are plain and decorated earthenware. The operations are two, the kilning of the biscuit and the firing of the enamel. The former requires a temperature not exceeding 1,100°C. and the latter 960°C. Both require an oxidising atmosphere. These furnaces have been in successful operation for several months. The biscuit heating has been accomplished in periods never exceeding 10 hours and the firing of the enamel in five to six hours without any trouble.

In the same issue M. Ch. Tixier presents a lengthy abstract of a series of articles in the German *G.W.F.* of October and November, 1949, on the elimination from gas of ammonia and hydrogen sulphide by means of water or ammoniacal liquor. The process applied to coke oven practice is as follows: Gas from the ovens is cooled and detarred and then sent to the washers which extract 70% of the $H_2S$. The gas is then washed in pure water which extracts more $H_2S$, and then debenzolised. After having been so far desulphurised the gas can be employed for heating the ovens or it can be completely desulphurised in a final stage of dry purification over oxide. The presence of sulphur in the benzole is thus obviated. The process envisaged is an improvement on that of Claus which was abandoned on account of the loss of ammonia, but in view of the present lack of financial interest in ammonia, it can be taken up again and improved. The scientific and technological problems involved are closely and fully discussed.

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# DOMESTIC COAL PROSPECTS

A NOTABLE improvement in the domestic coal position, particularly in the south, was referred to with gratification at a recent meeting of the Domestic Coal Consumers' Council held at the Ministry of Fuel and Power. Tribute was paid to the improved movement of coal on the railways and to the miners for their contribution, which has reduced the possibility of hardship which had been anticipated. Some easement had also taken place on boiler fuel, in large measure due to the milder weather, and this had materially reduced the pressure on the merchants.

General agreement was registered on the desirability of continuing to allow the maximum practicable stocking of coal and coke in the summer period, so far as fuel may be available for this purpose, to relieve the pressure for supplies in the winter months.

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# STEEL RATIONING

AN Order authorising a number of adjustments in the iron and steel distribution scheme came into operation on February 3. Consumers may use the stock held at the close of that day for a purpose for which they hold a control authorisation.

The holder of a control authorisation may send material out on loan to be worked up for him. This amendment is designed to cover the 'free-issue contract' customary in some trades for outside processing of material.

Two new items—wire rod reinforcement fabric mesh and wire reinforcement fabric mesh—are added to the list of controlled forms of steel. The list of small quantities exemptions has been extended to permit the purchase without licence of 5 cwt. a month of these items and also one ton a month of 'large spring.'

The Order is the Iron and Steel Distribution (Amendment No. 1) Order, 1952 (No. 172), and is obtainable from the Stationery Office (price 4d.). An 'Amendment No. 1, February, 1952' to the 'Notes for Consumers, January, 1952,' is also issued by the Stationery Office.

The Ministry of Supply has also announced that, as from April 1, 1952, the separate allocation of non-alloy steel sheet will be abandoned and that thereafter such steel sheet will, for allocation purposes, be merged in general non-alloy steel.

Consumers will be free to decide for themselves within their total authorised tonnage, how much they wish to order in the form of non-alloy sheet steel and how much in the form of other non-alloy steel (other than tinplate, terneplate and black plate, which will remain subject to separate allocation as at present). Outstanding sheet allocations on forms M (Sheets) will still be valid with their legal requirements unchanged.

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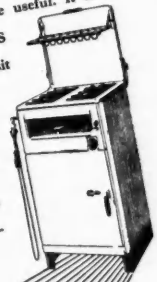
Employment in the chemical and allied industries in Great Britain in mid-November, 1951, is returned—in the latest figures issued by the Ministry of Labour—as 496,900, an increase of 1,000 on the mid-October position. Employment in the manufacture of general chemicals and dyes was 224,500 (174,100 male and 54,100 female). Persons previously engaged in the chemical and allied industries and registered as unemployed on December 10 numbered 4,182 of whom 1,654 were wholly unemployed, including casuals.

*The Glory of Achievement*

Some enterprising souls cross the Thames on tight-ropes: some write sonnets on threepenny-bits: others deck out fleas in immaculate evening dress for the public diversion. Our achievement is less spectacular, but we believe it to be infinitely more welcome and incomparably more useful. It is in fact the NEW WORLD 1840 GAS COOKER. We suggest you visit your local gas showrooms and assess its value as a practical contribution to civilisation. You will soon realise why two million happy housewives are saying:



...it's a NEW WORLD PRODUCT OF Radiation Ltd *for me!*

*"Two eyes see more than one..."*

Circumstances do arise when it is an advantage not to see too accurately. Nelson realised this and acted with commendable diplomacy on at least one occasion. There's nothing, however, about the NEW WORLD 1840 GAS COOKER to which one need turn a blind eye. It may be inspected under conditions where there is positively no deception, and no telescope is required to recognise its merits. Visit your local gas showrooms and see why so many clear-sighted people are saying—

a NEW WORLD PRODUCT OF Radiation Ltd *for me!*

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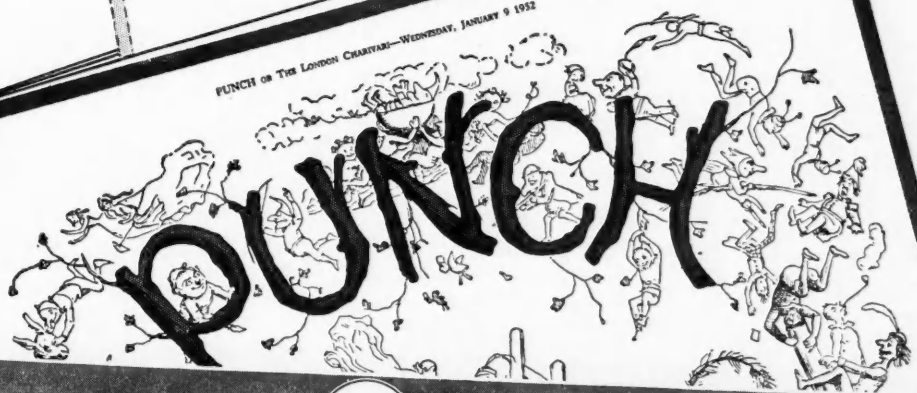
PUNCH OR THE LONDON CHARIVARI—WEDNESDAY, JANUARY 9 1952

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NEW WORLD NEW WORLD NEW WORLD

# ELECTRICITY IN GASWORKS*

By W. F. BLAKELEY, Assoc.M.Inst.Gas E.,
Chief Engineer's Department, North Eastern Gas Board.

APART from the heat requirements for making gas on the works and delivering it to storage, there are other power requirements, including handling of coal, coke, oxide, and similar materials; pumping of tar, liquor, oil, cooling water; pumping of gas from the works to the point of consumption by boosting or compressing plant. These requirements can be met by electricity; and unless there are special circumstances, it will normally be a more economical proposition to purchase electricity from an outside source. The possibility of failure cannot, of course, be overlooked, and it is advisable to provide two feeders into the works so that in the event of one cable failing the other can be brought into use. Internal ring mains are recommended as this method will give the greatest safety at the minimum cost against cable or switchgear failures in the works and maintenance of switchgear will be assisted. Few power failures last more than an hour or two, and it may be more economic to reduce output for a few hours rather than to install large expensive standby plant which will rarely be used.

To arrive at a suitable capacity for standby plant a careful survey of all running plant should first be made and the minimum power requirements assessed to keep the works in operation. It is unlikely that the whole of the plant included in the survey will be running at the same time, and allowance should be made for this. It is nevertheless necessary to include for emergencies and future expansion. Wear and tear, the possibility of overloads, overall power factor of the system, and transmission losses are also factors to be taken into account.

Having assessed the possible power requirements it is then necessary to consider the type of prime mover which will be provided. As the small and medium sized steam driven generating plants are not usually the most economical in steam (of the order of 40 lb. of steam per B.H.P. per hour) and as this could only be provided from additional boiler plant, consideration should be given to an alternative form of drive.

It is suggested that, bearing in mind the following points, the diesel drive standby generating set merits serious consideration.

(i) The plant can quickly be started and put on load.
(ii) The storage of fuel oil is a simple problem and supplies are normally readily available.
(iii) It is independent of steam with its attendant additional boiler capacity and labour requirements.
(iv) The plant is economical to run and the fuel consumption is approximately proportional to load.
(v) Standby losses are small compared with steam.
(vi) Initial cost is often low—*e.g.*, a 250 kVA diesel alternator (quite large enough for emergency operation of a medium sized works) can be purchased for about £7,000.

## Types of Motor on Gasworks

By far the most widely used type of A.C. motor constructed today is the induction motor. This machine is made in two general varieties, the squirrel cage motor type and the slip ring wound rotor type. The squirrel cage type is extremely robust but suffers from the disadvantage of relatively small starting torque and high starting current. An interesting development in squirrel cage motor construction is known as the 'high torque' motor. By means of a specially constructed rotor the starting torque is increased and the starting current reduced. Electricity supply authorities usually set a limit to the size of motor which can be started by direct switching. This usually depends upon the method of supply. If this is from a low voltage network then the maximum motor which can be so started may be as low as 2 H.P. On the other hand where supply comes directly from a high voltage network—*i.e.*, where a sub-station is sited on the gasworks—it may be possible to start up 50 or 100 H.P. by direct switching. Before ordering any motor and starter the supply authorities should be consulted on this point.

The wound rotor type, by the introduction of starting resistances in the motor circuit by means of slip rings, enables a measure of control of starting current to be made and can be designed to give a higher starting torque.

*The Gasworks Motor.*—This machine has been especially developed from long experience with electrical plant under the conditions found on gasworks. It is eminently satisfactory and thoroughly reliable. The gasworks motor is a totally enclosed machine completely dustproof and exceptionally robust both mechanically and electrically. It is made in A.C. and D.C. types and in a wide range of capacity.

*The Flameproof Motor.*—This is also a totally enclosed machine designed to comply with the requirements of the Buxton Testing Department of the Ministry of Fuel and Power. It is designed to comply in all respects with the British Standard specification for rating temperature rise overload and high voltage tests. It is not generally realised that a flame proof motor is neither gas tight nor water tight. When installed out of doors a hood should be provided to protect it from *direct* rainfall. In any installation which includes flameproof motors it is equally necessary to ensure that all fittings, cable glands and starting equipment are of certified flameproof pattern. Attention is drawn to the I.G.E. Safety Recommendations recently issued.

*The Pressurised Motor.*—This motor relies upon the provision of a supply of clean air under slight pressure continually circulated through the inside of the motor while it is running. This is usually provided by the use of a separate motor driven fan either mounted on the frame of a main motor or separately housed outside the danger area. A recent development of the pressurised system is its adaptation to lighting. Pressurised lighting is used where a severe hazard exists with a risk of concentration of water gas or other Group 4 gas.

An alternative method to either the flameproof or the pressurised motor is by the use of a non-flameproof motor housed in an adjacent room outside the possible contaminated atmosphere. In this case the drive is taken from the motor through a specially designed sealing gland to the compressor or booster in the adjoining room. Whichever method is adopted will depend upon the economies of the particular case and no generalisations can therefore be made. A point frequently overlooked is that inside the driven unit house there should be some means of stopping the motor. Any such equipment must be of flameproof construction.

*Variable Speed Motors.*—The normal motor drive for gasworks use is of the constant speed type for which the starting and control equipment is relatively simple. There are, however, certain drives, to which increasing attention has been given in the last few years, which necessitate, if they are to operate efficiently, the provision of a variable speed drive. In this category come the gas boosting plants now becoming a familiar feature in all works where the transmission of gas to outlying areas is required. It is also sometimes desirable to provide a variable speed drive to exhausters used in connection with water gas plants. An interesting adaptation of a variable speed motor drive of this nature was recently carried out at

* Abstract of a paper to the Yorkshire Junior Gas Association, Leeds. January 16, 1952.

Leeds. In this case the rise and fall of the relief holder was transmitted mechanically to an induction regulator controlling the speed of an A.C. motor. The motor formed the drive to an exhauster taking gas from the relief holder and passing it forward through the remainder of the plant. This application enables the exhauster speed to be adjusted to suit the amount of gas in the relief holder, thus assisting in smoothing out the unavoidable fluctuations inherent in the water gas manufacturing process.

### Gas Pumping and Storage Station

The following is a brief outline of the application of electricity to a completely automatic high pressure gas pumping and storage station built by the former Leeds Corporation Gas Department in 1947. The installation stores 500,000 cu.ft. of free gas in three receivers each 24 ft. inside diameter x 107 ft. long at a working gas pressure of 55 lb. per sq. in. There are two vertical two-crank reciprocating gas compressors each having a capacity of 42,000 cu. ft. of free gas per hour at 55 lb. per sq. in. and arranged to run alternatively.

The drive is by 100 B.H.P. electric motors fixed in a separate room, connected direct to the compressors by extended shafts passing through wall sealed glands. All the electrical equipment is fixed in the motor house. The starters have a three position switch, hand, automatic, and off. The compressors are fitted with hand controlled unloading gear, so that either set can be run light.

Gas is supplied to the district from the receivers through 14 in. dia. Reynolds district governors, in duplicate operating at an inlet pressure of 1 to 55 lb. per sq. in. and outlet pressure of 3 in to 6 in. W.G.

A special circuit breaker is required similar to mining type gate end breaker fitted with a five pin plug socket.

The whole station is entirely automatic. The operation of the plant is controlled by three main factors:—Time; gas conditions in the low pressure mains; and gas conditions in the receivers.

A selector switch chooses No. 1 plant as starter and No. 2 plant as standby or *vice versa*. Each plant is equipped with its own set of automatic devices consisting of high pressure relay switch, low pressure relay switch, time switch, pilot unloader, and thermostat switch.

The time switch is set for midnight to 6 a.m. (or any other time). The low pressure switch is set at 25/10 in. W.G. (or any other pressure). The high pressure switch is set at 30 lb. per sq. in. on the lower limit (or any other pressure). When the time switch closes, then, provided the gas in the low pressure main is more than 25/10 in. W.G. and the pressure in the receivers is less than 30 lb. per sq. in., No. 1 starter will be put on the line. The starter immediately energises the pilot valve which unloads No. 1 compressor and closes the high pressure station governors. The compressor runs up to speed on no load, the pilot valve becomes de-energised, and the plant is then on load.

Cooling water is supplied to the gas cylinders and intercoolers by centrifugal pumps driven from the compressors drawing water from six water tanks.

The plant continues to run until the receivers reach 55 lb. per sq. in., or the low pressure gas supply drops below 25/10 in. W.G., or the time switch opens.

A thermostat switch would stop the plant in the event of the cylinder temperature reaching a predetermined maximum. The plant would also stop in the event of the driving motor going on single phasing.

The plant is unattended and completely automatic.

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# *The Application of*

# GAS TURBINES IN THE GAS INDUSTRY

**Discussion on A. W. Pope's paper to the London and Southern Section of the Institution of Gas Engineers, which was published in the *Journal* of February 6.**

**Mr. L. J. Clark** (North Thames) said that they had listened to a masterly survey of the development of the gas turbine. The author had the great advantage of seeing the progress made by the gas turbine in the aeronautical sphere, and Mr. Clark had no doubt he had contributed very materially to this country's pre-eminence in that field. Although, industrially, the gas turbine had not made the startling progress it had in the air, historians would probably show that the rate of development had been much faster than other prime movers. It must be remembered that nearly all the development work had taken place since the war, and enormous sums of money were being spent by engineering firms on research into this subject. They would see many other fuels being used in the near future. All this work had been very much encouraged by the Ministry of Fuel and Power because of the urgent need to stem the gap between fuel production and power demand. It might be wondered whether town gas itself would have any useful application, though the most promising line of development in this country was in the use of coal and low grade fuels. Mr. Clark doubted whether town gas could be used economically except in special circumstances. There was the disadvantage of having to compress the gas and so lose a little efficiency.

He had recently had the opportunity of seeing a machine burning peat which showed high promise. Mr. Pope had acknowledged the brilliant work which had been done in Switzerland where they had approached the problem from the line of the conventional steam turbine, whereas in this country they had approached it from the line of the aero engine. If they approached the matter from the angle of aeronautical practice there was the question of securing long life, for which all engines were not designed. There was a very wide range of design from the simplest open cycle machine of low efficiency and small capital cost to the highly complicated machine using expensive heat interchangers, etc. Between those two extremes one could select a design most suited to the particular application, with a wide range of horse-power. That fact was of great interest to the gas industry with its large variety of power requirements.

Waste heat was ideally suited to the gas turbine, continued Mr. Clark. No further dilution was necessary so that the exit losses were low. The reject heat was at a higher temperature than with the steam turbine. Some attention must be given to the design of the air filter on the inlet of the compressor to protect the blades from dust. It could probably be of the two-stage type—first viscous and then fabric. If it was of fabric only its life would be fairly short. He was disappointed that there had been no reference to the waste heat project for Coventry, employing the closed cycle system and incorporating many interesting features, which was well on the way to completion.

**Captain (E.) W. Gregson,** R.N.R. (visitor), said they were now seeing the basic problems underlying the gas turbine as an industrial unit reasonably solved. He felt the time had come to put into practice what had been his ambition for many years —*i.e.*, an air turbine energised by the sensible heat in waste gases. In continuous vertical retort practice the waste gas flow was at an ideal temperature for heating the air to operate

the turbine to the order of 600°C. (1,112°F.) and, of course, a plant of this type involved no combustion problems as the sensible heat in the waste gases from the settings represented the source of heat intake. After a survey of the types of turbine then available as an industrial prototype, the closed-cycle machine constructed by John Brown's, of Clydebank, with compressor blading designed by Escher-Wyss, was adopted for the first installation, and West's Gas Improvement Co., Ltd., associated themselves with Spencer-Bonecourt, Ltd., in developing a prototype plant for installation at the (then) Coventry Corporation Gas Department's Foleshill works. The West Midlands Gas Board had shown the same progressive spirit and outlook as their predecessors.

Captain Gregson showed slides of various details of the plant which is now nearing completion at Clydebank; he pointed out that the turbine itself very closely followed steam turbine practice, and drew attention to the sealing arrangements for the bearings of both turbine and compressor to avoid any possibility of lubricating oil entering the air circuit. The compressor was of particular interest. The original Escher-Wyss design incorporated all-axial flow blading, but in view of the comparatively small volume of air at the higher pressure stages (the turbine inlet pressure was 140 lb. per sq. in.) it was decided that the latter stages should be of the centrifugal type. The diffuser through which the air passed from the axial to the centrifugal stages was designed to convert the kinetic energy of the air into pressure energy, and an intercooler was disposed between the two sections—all with a view to getting the highest possible compressor efficiency with consequent reduction in negative work. The regenerator was a very compact unit made up of small diameter tubes, as with clean air on both sides of the surface cleaning should be unnecessary. The main air-preheater consisted of three banks of tubing in series, the hot section—*i.e.*, that first in contact with the waste gas flow and the hot air collecting header—being fabricated from F.C.B. heat resisting alloy. The cooler sections were of carbon steel. The air preheater assembly was arranged for easy cleaning on the hot gas side. The waste gases from the settings after they had passed over the air heater tubes carried on to the standard type of waste heat boiler with its induced draught fan.

A further feature of interest at Coventry was that starting up would be effected by steam turbine, and this machine could be kept in continuous operation as a power-augmenter to the gas turbine should excess steam be available from the works supply. The water for cooling purposes—from the intercooler, precooler, oil coolers, etc.—was well water gravitating from the works overhead supply tank, and after doing its work would pass to the water softening plant for general works supply. This meant that the heat extracted from the gas turbine circuit by the coolers was re-absorbed into the works circuit as part of the hot-process softening system.

The gas turbine unit was geared to an alternator and the whole plant would be installed in a slightly pressurised engine room within the retort house itself, the idea being to prevent any ingress of dust to the turbine room when doors were opened. Captain Gregson stated that he hoped the plant would be in operation this coming autumn, and stressed the fact that reliability in operation had been aimed at rather than securing the very highest thermal overall efficiency for the prototype unit.

## Closed v. Open Cycle

**Mr. L. T. Minchin** enquired what was the advantage of the closed cycle as compared with the open cycle.

**Mr. Pope** replied that no one knew which would prove to be the better. The closed cycle did not need a filter, while it also had some little advantage in higher power, but it had no special advantage with low and medium powers.

**Capt. Gregson** observed that one of the disadvantages of the closed system was the inordinate amount of cooling water required. The amount of water required by the Coventry plant was almost as much as the total amount used for all other works purposes.

**Mr. C. G. Conway** (Chief Scientist's Department, Ministry of Fuel and Power) (visitor) said that Mr. Pope should be thanked for drawing the attention of industry to the uses of the gas turbine as a means of saving waste heat in the chemical process industries, in which he would include the iron and steel industry and the gas industry. He would confine his main remarks to the blast furnace. While not wishing to quibble over figures, he would point out that the general overall efficiency of the steam turbine driven compressor and Cowper stove for feeding hot air to a blast furnace was of the order of 55%, and that using a gas turbine drive with heat exchanger would enable one to obtain at best about 69-71%, not the 75% claimed by Mr. Pope. As the losses in the process were mainly the exhaust gas and the losses from the heat exchangers, it would be seen that the efficiency could not be much higher than 70% due to the high exit temperature in the gas turbine exhaust. Cowper stoves were admittedly costly, but they were not inefficient. In the past he had committed the error of running down the Cowper stove in favour of the tubular air heater, but there was a case for the Cowper stove since, particularly at the present time, the technical position of the blast furnace was so uncertain. It was not known whether higher top pressure would be used, with or without oxygen enrichment of the blast, or whether the temperature of the operation would soar or decrease as it appeared to be doing at present. Consequently if one installed a tubular air heater instead of a Cowper stove for a fixed maximum temperature of air blast of 700°C., it would not be possible for long-term service to increase this temperature by, say, 50°C, whereas a Cowper stove gave one greater flexibility of temperature operation.

Mr. Pope had outlined the scheme for waste heat recovery in connection with Kensal Green station of the North Thames Gas Board, and Captain Gregson had added some remarks on the Foleshill plant. In the case of the Kensal Green plant, the output would be increased from about 1,000 to 1,400 kW and it would be interesting to know the capital cost entailed in such an increase. He pointed out that it would be essential to have in the description of the operation of such plants—for example, the Foleshill plant—an account of the cost of the installation in terms of the power produced.

There had been some discussion on the relative merits of open and closed cycles. He would like to add a remark that whereas the St. Denis and Dundee stations built on the Escher-Wyss cycle would have pressurised combustion, it appeared unlikely that John Brown and Company would make other than atmospheric combustion chambers using a radiant heat section in the air heater in future. This destroyed one objection to the use of solid and residual fuels with the closed cycle. Mr. Pope was correct in saying that the future of the gas turbine in this country depended essentially upon being able to burn coal or other indigenous fuel, and it appeared that the greatest hindrance to this would probably be the cost and method of gas cleaning in the open cycle.

**Mr. Taylor** said the gas turbine gave the opportunity of utilising power in the middle stages. He was not quite clear whether Mr. Pope was considering a short life turbine or one designed to run for 50,000 to 100,000 hours.

## Standby Source of Energy

**Mr. H. R. Lupton** (visitor) referred to a field for which he thought the gas turbine might be well suited—that of providing a standby (low load factor) source of energy for vital services in case the power supply should fail. He was thinking particularly of large water supply stations, the Metropolitan Water Board having ordered three gas turbine alternators, of about 2,500 kW each for this purpose at their new Ashford Common works.

In this application gas turbines were rather like the stores of tinned food accumulated by a careful housewife against emergency. Such stores took up little space, needed no attention to keep them in order, were available at a moment's notice. *But* such a store was expensive to set up initially, and to live on tinned food was extravagant. In fact, in spite of the smaller buildings required, as compared with diesel alternators, and the lower upkeep cost expected, it was only by a narrow margin that gas turbines scraped home at Ashford Common—and those only of the simplest open-cycle design without heat exchangers. They would never have been chosen unless it had been intended that they should hardly ever run. A thermo-dynamician could not fail to be attracted by the closed-cycle, multi-reheater, multi-intercooler, high-effectivity, heat-exchanger machine, which at present temperature ranges had an ideal (Carnot) ceiling efficiency of some 70%, and achieved in practice fully half this figure. In the long run, large engines (Escher-Wyss, he thought, suggested 12,500 kW as a minimum for this type) must compete, for power station work, with steam which was tied to a lower ceiling efficiency, due to the necessity to take in a large proportion of the heat at the saturation temperature.

**Mr. L. H. Brown** B.SC., M.I.C.E., M.I.W.E. (Engineer and Manager, Mid-Northamptonshire Water Board) (visitor) pointed out that in waterworks there was no waste heat to be harnessed to the driving of gas turbines, and that they had to buy fuel and

(*Concluded on page 488*)

# TECHNICAL AND SALES REQUIREMENTS FOR APPLIANCES

By G. H. FUIDGE, B.Sc.,

Chief Physicist, South Eastern Gas Board.

**An acceptable appliance, the author points out in this paper to the London and Southern Junior Gas Association, has to meet not only a range of technical requirements, but also a number of what may be termed sales requirements. It is unfortunate, he remarks, that these two groups are not always concordant; in fact in some cases they are definitely opposed. As a result, when a new appliance is being developed it is often necessary to strike a balance between certain incompatible requirements and to exercise much ingenuity to solve the technical problems that arise from an improvement in some particular sales feature and *vice versa*. The author sets out in broad outline the requirements that must be met by a satisfactory appliance.**

THE gas industry is fortunate in that most of the domestic gas appliances and a proportion of the coke appliances are sold to the consumers directly by the industry through its representatives or in its showrooms. This means that we can effect a considerable degree of control over the design and performance of the appliances and in general they are only offered for sale by gas boards when they have been approved as technically satisfactory by the industry's laboratories and have been selected by the commercial authorities as likely to appeal to prospective purchasers.

The technical requirements for gas and coke appliances are set out in a number of British Standards, B.S. 1,250, 1,251, 717, 758, 1,115, etc. B.S. 1,250 is at present in the course of revision, but although many alterations and improvements in detail will be made, the basic principles will remain the same. The technical requirements can be summarised as follows:—

(i) That the appliance is safe.
(ii) That the appliance shall perform satisfactorily the function for which it is designed—*e.g.*, cooking, water heating, space heating, refrigeration, etc.
(iii) That the appliance shall be durable.
(iv) That the construction is such that it is reasonably easy to fit and to maintain, in particular that components can be replaced without great difficulty.
(v) That the appliance has the highest possible thermal efficiency commensurate with the other requirements.

The sales requirements for an appliance, by which is meant those features that make the appliance likely to sell readily from showrooms or at exhibitions, can perhaps be said to comprise the following:

(i) The price must be reasonable and in certain circumstances as low as possible.
(ii) The appliance must be attractive in appearance and in conformity with modern trends of design of furniture and other household equipment.
(iii) The appliance must be simple and convenient to use and easy to keep clean.

In view of the necessity that appliances shall meet these sales requirements it is clear that great care has to be taken in drawing up technical specifications, to avoid making the requirements unduly restrictive on new developments and to avoid insisting on requirements which although desirable, may not be essential and which may unjustifiably increase the cost of the appliances. Similarly, care is necessary in the interpretation of the specification both by those engaged in designing the appliances and those carrying out the tests for acceptance on the part of the gas boards. It has to be borne in mind that the specification is merely a means of ensuring that the appliance satisfactorily performs its functions and is not an end in itself. It is all too easy to design an appliance merely to pass the specification and it is equally easy for an examining laboratory to reject an appliance which because of certain novel features is outside certain clauses of the specification and yet is fully satisfactory as an appliance; in such a case a revision of the specification would be called for. Similarly, when sales staff both of the appliance makers and of the gas boards are considering modifications which are intended to improve the appearance or in other ways make the appliance more saleable, it is important that the technical implications of the modifications are fully taken into consideration.

In the last 20 years there have been rapid developments in the design of appliances as can be seen by comparing almost any type of appliance of pre-war design with one of present-day design. Changes have occurred in the technical performance, in the materials of construction, and in the appearance, the last being perhaps the most striking. In most cases, of course, the changes represent considerable improvements, although in some cases this is not necessarily so and there are instances where in my view there has been definite retrogression in particular standards due, of course, to fixing the compromise between the various requirements at some different position.

It might be of interest briefly to review the changes that have been made in the more important types of appliance, to consider the present-day models in relation to the technical and sales requirements already outlined, and to refer to some of the technical and design problems that have had to be solved in the development of the new appliances.

## Cookers

Very great changes have taken place, particularly in the appearance of cookers. The open construction with ribbed and panelled surfaces has given place to a more simple box-like form with smooth surfaces as free as possible from projections, and all exposed surfaces have some form of durable and non-corrodable finish. All the larger metal surfaces are vitreous enamelled and fittings are plated or have plastic coverings.

These changes represent considerable improvements as regards the sales requirements of appearance, ease of cleaning, etc., but they have given rise to a number of important technical problems.

*Vitreous Enamel.*—The vitreous enamelling of all the major components of the modern gas cooker has perhaps been responsible for the most striking improvement in the appearance and cleanability of the gas cooker. However, many technical problems have had to be solved. When vitreous enamel was only used for the oven door and the sides, the quality of the enamel was not of very great importance since in these positions the enamel was not subjected to severe conditions. The enamelling of the components of the hotplate, the pan supports, and the burners themselves requires enamel of special quality to ensure satisfactory durability. The enamel on the hot-

plate must be resistant to thermal shock, resulting from the spillage of water on to the hot surface, it must withstand repeated heatings and coolings without crazing, it must not be scratched by the cleaning agents used to remove burned-on fat, etc., and it must be unaffected by the dilute acid in fruit juices and in the condensate from products of combustion.

It is sometimes said that the quality of enamel used on cookers has deteriorated as compared with that used in the past. This is not the case and any faults that have developed have been due mainly to the enamelling of those parts of the cooker which were not previously enamelled and which subject the enamel to unusually rigorous conditions.

*Use of Pressed Steel.*—To take advantage of modern production methods there has been a considerable change over from cast iron to sheet steel in the construction of cookers, and in certain cases, apart from burners and fittings, sheet steel is used throughout. This change has also introduced enamelling problems. Sheet steel is less rigid than cast iron and flexing of the steel plate or accidental impact with the sheet may cause the enamel to flake when enamelled cast iron would remain free from damage.

To deal with these problems it has been necessary for appliance makers not only to use high grade heat resisting and acid resisting enamels, but also to exercise careful control over the application of the enamel and use thin layers which are not stressed so severely by flexing and changes in temperature. This in turn has necessitated the use of pigments of high hiding power. Greater care has been required in the packing and transport of the cookers in view of their vulnerability to mechanical damage.

*Semi-solid Hotplates.*—The modern semi-solid hotplate represents a great improvement in appearance over the older type with bars, but it has given rise to many difficult technical problems. Firstly, as regards safety, it is essential that under all conditions of use the products of combustion from the appliance shall be innocuous and therefore that combustion shall be complete. With the open bar type of hotplate there was ample space for the escape of products of combustion and whatever type of vessel was placed on the boiling burners smothering by restriction of the escape of products could not occur. It is easy to see that with the semi-solid hotplate, in which there are openings for the escape of products only around the pan supports, the use of utensils of large size and in particular utensils such as buckets with rims on the base may seal the openings for egress of products. This possibility of the smothering of burners by rimmed vessels was not fully realised at first and some of the eary semi-solid hotplates were capable of giving dangerous conditions for this reason. To prevent the trouble occurring it has been necessary to arrange for the hotplate to have projections or depressions or for the pan supports to be at a different level from the rest of the hotplate. Unfortunately, this has detracted in some measure from the value of the semi-solid hotplate, since these projections or depressions make cleaning rather more difficult and also may reduce the stability of small saucepans. The design of a semi-solid hotplate which is fully safe and yet is reasonably easy to clean and gives stable support for saucepans has called for considerable ingenuity on the part of appliance makers.

*Light Coloured Hotplates.*—These are very attractive in the showroom, but in this case the technical objections are in my view very strong. The hotplate is a working surface; it is bound to get hot and spillage of cooking liquids cannot always be avoided. The spillage, especially of fat, may become partially carbonised and form a dark coloured strongly adhering film. The difficulty of removing such stains has given rise to many complaints that the new cooker is less rather than more labour saving than the old type. Stains are much less evident on black or dark coloured hotplates, and if the cleaning is not thorough the effect is not very noticeable. Moreover, any small blemishes in the enamel, either in the form of pinholes on the new appliance or small chips arising from use, show to a greater extent on a light than on a dark surface. Many dark enamels can be applied in a single coat and in any case the problem of hiding power does not arise so that the thin layer necessary for resistance to thermal shock is easily attained. A light coloured enamel cannot be directly applied to the metal and therefore at least two coats are required, and to obtain adequate opacity the enamelling operators may tend to apply the enamel in excessive thickness.

*Vitreous Enamel on Burners.*—For reasons of appearance, durability, and ease of cleaning, it is a great advantage to have the hotplate burners vitreous enamelled and this is done on most modern cookers. Difficulties have arisen due to the vitreous enamel flowing into the burner ports and reducing their size. It is essential for satisfactory combustion that the total area of the burner ports should be within close limits. It has therefore been necessary to adopt special enamelling techniques or special burner design to keep the flame ports free from vitreous enamel.

*Enclosed Grill Space.*—The enclosing of the space under the hotplate has tended to increase the temperature of the components and in many cases special steps have had to be taken to keep the surface temperatures of those areas likely to be touched below the limit of 250°F. and also to prevent the barrels of the taps from becoming too hot, with a resultant loss of tap lubricant and ultimate seizure of the taps. In some cases it has been necessary to fit special shields to protect the taps from radiation from the burners.

*Improved Technical Performance of Cookers.*—It should not be thought that all the improvements in cookers have been in appearance and cleanability. Since the introduction of B.S. 1,115, now being incorporated in the revised B.S. 1,250, the cooking performance both as regards uniformity of cooking and in the time required has been considerably improved. Modifications in oven design and better insulation have resulted in the gas consumption being markedly reduced. The efficiency of boiling burners has been increased and the liability to back-fire or incomplete combustion has been reduced. The standardisation of burner performance and the avoidance of combustion troubles due to maladjustment is greatly facilitated by the use of fixed injectors and governors. This arrangement, however, introduces sales and commercial difficulties since a fixed injector is only suitable for gases within a limited range of characteristics. In areas where the undertakings distribute gases of various calorific values and specific gravities and where appliances are distributed from central stores, in many cases it has not been found possible to adopt the principle of fixed injectors.

The problem has been met to a considerable extent by the introduction by the Society of British Gas Industries of standardised gas groupings. These are arranged to the Wobbe number of the gas $\frac{\text{Calorific Value}}{\sqrt{\text{Specific Gravity}}}$ which determines the thermal discharge of a burner injector at a fixed gas pressure. Each gas grouping covers a range of about $\pm 5\%$ in Wobbe number and one injector is suitable for any gas within this range. In the South Eastern Gas Board, though it has not yet been possible fully to standardise calorific value, it was early found that the various types of gas supplied could be put within one or other of two Wobbe number groups, corresponding to the S.B.G.I. groups 4 and 5. It is intended that ultimately all the gas shall be within G.4; at present nearly 90% is within this group. By adopting this grouping there has been no difficulty in supplying throughout the area all appliances with fixed injectors.

## Water Heaters

The selection of the most suitable type of water heater for a particular purpose or situation provides a good example of the necessity to effect a compromise between conflicting requirements, not only between sales and technical requirements, but also between different standards of technical performance. Recent developments also show that the solution of certain problems may give rise to disadvantages or difficulties in other directions.

It is not necessary to enumerate the relative advantages of instantaneous and storage water heaters since these are well

(*Continued on page 487*)

known, but it should be mentioned that the arrangements in many modern dwellings are more suitable for storage water heating, particularly where a solid fuel system with storage tank is provided for winter hot water supply.

*Storage Heaters.*—For the best hot water service the storage heater should incorporate a circulator of high gas rate giving rapid rate of recovery. Such circulators, however, must in all circumstances be flued to the outside, and this is inconvenient in some situations, particularly in new housing schemes where the heater is perhaps required to be an alternative to an electrical storage heater. In such a case, the advantage of the low recovery rate storage heater, with a thermal input of about 6,000 B.Th.U. per hour, that in suitable conditions it need not be flued, may outweigh the disadvantages. The effect of the low rate of recovery can be offset to a considerable extent by the incorporation in the storage tank of the so-called economy valve, which enables the top three gallons to be heated independently of the remainder and thus give quickly a small quantity of hot water such as is required for ablutions or sink use.

From the point of view of appearance it is desirable to incorporate the circulator within the jacket of the storage tank and thus produce an appliance without any excrescences. For other reasons, however, it may be more convenient for the circulator to be supplied separately and fitted to the storage tank *in situ*. A convenient range of lagged storage tanks with or without ball-valve feed tank and with tappings for both solid fuel and gas circulators has recently been made available.

*Instantaneous Water Heaters.*—The bath water heater has given good service to the industry, but it is realised that it has disadvantages from the technical and sales point of view. The orthodox 'geyser' is not in keeping with modern household fitment design and in certain recent appliances attempts have been made to improve the appearance and remove fittings and pipes from the exterior to within the casing. The problem of corrosion of the interior of instantaneous heaters generally has been the subject of much study, but has not yet been solved. In the case of bath heaters further consideration is being given to the open type, in which corrosion and scale formation are both reduced and which are simpler in construction than the more usual closed type.

To give an adequate stream of running hot water for bath or multipoint use the gase rate must be high. These heaters are large and require large flues. In the case of the large multipoint the large amount of air used for combustion and the large volume of products that might be forced into the room in the case of down-blow make it essential that the room in which these appliances are fitted is well ventilated.

The recent development of the balanced flue water heater is a case where both technical and sales requirements have been met. The elimination of the draught diverter has reduced the height of the appliance, and in one form the projection into the room has also been reduced so that the whole appearance has been considerably improved. The technical improvements are even more important. Since the heater is completely sealed from the room the problem of safety in respect of products of combustion has been solved. The ventilation of the room need no longer be considered and the appliance can therefore safely be fitted in any room, including a bathroom. This constitutes one of the most important technical developments associated with the balanced flue water heater. All the problems associated with the instantaneous heater have not, of course, been solved; in fact, certain new ones have been introduced. For example, the heater must be fixed on an outside wall, which in many modern buildings is difficult because of the small area of wall space not broken by windows, etc. With the present design a large hole is required in the wall which makes the fitting in existing buildings rather difficult. Owing to the circulation of the outside air through the heater there is rather more danger of freezing of the waterways in winter and it will probably be necessary for the heater to be drained if it is to remain unused with the pilot not alight.

With the increased complexity of the flue arrangements and the structural work involved in fitting it is unlikely that the introduction of the balanced flue principle will reduce the cost of the multipoint heater. It is to be hoped that in the future the principle will also be applied to the single-point bath heater in a form which will make fitting in an existing house reasonably easy and cheap.

The incidence of purchase tax has meant that, in general, gas water heaters do not meet the sales requirement of low cost, and there is a need for new water heaters of novel and simple design which are cheap. To achieve the low cost it may be necessary to relax some standards, providing the main technical requirements of safety and production of adequate hot water are retained.

## Space Heating Appliances

There have, of course, been alterations in the design and external finish of all types of space heating appliances to bring them in accord with modern fashion in furniture. In the case of gas fires important developments have been the use of the neat burners in place of aerated burners and the use of a combustion chamber and screening fret in place of the ordinary type of radiants.

The use of neat burners has had the important sales advantage of rendering the fires quite silent. The screening fret, particularly when in the form of separate robust bars, has greatly increased the durability of the refractories and thus correspondingly reduced maintenance. On the other hand, the need for more accurate dimensions for the refractory components has required new methods of fabrication, which has tended slightly to increase the initial cost. The use of neat burners has tended to make the appliance more sensitive to the presence of condensible hydrocarbons in the gas and special care in design and dimensions is necessary to ensure that soot formation shall not occur when the concentration of hydrocarbons is high. One result of this has been slightly to reduce the radiant efficiency compared with the best obtainable from aerated burners and column radiants.

Thus the improvements given by the neat burner fret fire have been accompanied by certain minor disadvantages, but taking everything into account it is considered that from both the sales and the technical points of view the new fire represents an advance in standards.

The slightly reduced radiant efficiency of the fret type of fire has been more than offset by the development of 'convector fires' in which room air is warmed by passing behind the back brick and through a heat exchanger above the fire. For this type of fire the efficiency is 10-15 units of percentage higher than that of the ordinary fire. In this case the technical advantage has been offset by the sales disadvantage of increased cost accentuated by purchase tax, and further development along these lines has been retarded. It is hoped that the present renewed interest of local authorities in space heating by gas will provide the necessary encouragement for the production of more fires of this more efficient type.

New types of balanced flue space heaters have been introduced, and these meet several important technical and sales requirements. Technically, the heater has the advantage over the flueless space heater that the products of combustion, which in the case of the flueless heater lead to an increase in humidity and possible smell, are not discharged into the room.

Compared with the more usual type of flued domestic space heater the balanced flue heater has the advantage that the efficiency is much higher, the relative figures being of the order of 75% and 45%. The efficiency of the balanced flue heater is only limited by the need to avoid condensation both in the heater and on the external wall around the flue terminal. Since the gas rate of a space heater is much lower than that of a multipoint water heater, the air duct and flue terminal may be much smaller, and in the case of one balanced flue space heater both are contained within the area of the face of a building brick.

The balanced flue heater can, without difficulty, be made attractive and unobtrusive in appearance. Unfortunately,

owing to the more complex construction and fitting of the appliance the cost is high compared with both flueless heaters and gas fires. It must be remembered, however, that the heaters are intended to be used in situations where flueless heaters are unacceptable. Compared with gas fires the cost of the chimney is avoided, which may represent a large sum, for example, in the case of multi-storey flats.

## Coke Appliances

During the last 20 years and particularly since the war there has been rapid progress in the combustion of solid fuel in the home, and it can be claimed that this started with the introduction in 1928 of the first coke fire. The modern improved solid fuel grate sponsored by the Ministry of Fuel and Power is based on the pre-war open coke grate and as one step in the implementation of the recommendations in the Simon Report all these modern solid fuel grates are required to give satisfactory performance with coke as a fuel.

So far as the use of coke is concerned, however, all the developments in grate design have not been technical advances. The original coke grate was designed specially to burn normal gas coke. It had a compact deep firebox which enabled coke, even when of low reactivity, to be burnt easily and it had widely spaced bars at a fairly steep angle to the horizontal to enable the rather large amount of ash of flocculent nature associated with most of the gas-making coals, in contrast to the best house coals, to be removed from the fire without difficulty.

From the sales point of view, however, the grate was considered to compare unfavourably in appearance with that of the stool bottom grate fitted into modern fireplaces. In later designs of coke grate therefore, the slope of the fire bars was less steep; this enabled the front to be reduced in height and to have proportions more similar to those of the coal grate. To meet the further sales requirement of cheapness and convenience in fitting the plan dimensions were altered to those of the normal coal fireplace. Because of the greater radiating area the rate of combustion per unit grate area had to be reduced, which made it rather more difficult to burn unreactive cokes.

## Positive Air Control

An important technical development, which increased the convenience of use of the coke grate and enabled it to burn without extravagance the more reactive fuels including coal, was the provision of positive air control to the underside of the grate. This ability to burn a wide range of fuels was one of the main reasons why the coke grate was used as the basis for the improved solid fuel grate. The need to avoid high ashpit losses with coal has, however, led to a reduction in the air spaces between the fire bars. This has made ash removal more difficult and of course this problem has been aggravated by the higher ash content of coals supplied since the war.

Thus the greater convenience of fitting and the wider range of fuels that can be used by the modern grate has resulted in its being rather more selective in the type of coke that can be burned satisfactorily. The problem has been dealt with as far as possible by the Coke Department of the Gas Council recommending to area boards standards for the quality of coke suitable for domestic purposes.

The most important technical development in connection with solid fuel appliances is the greatly increased efficiency. The incorporation in the open fireplace of a back boiler and arrangements for heating convected air has increased the overall efficiency to some 55% with coke and 40% with coal, compared with about 20% for the stool bottom grate without back boiler and burning coal. An even more efficient appliance is the openable stove, for which the efficiency with coke is about 60% and with coal about 45%. Unfortunately, many of these efficient appliances are not nearly so attractive in appearance as some of the open fireplaces with the stool bottom grate and there is need for first class artistic design to improve as fast as possible the appearance of the efficient appliance. It is probably impossible to produce a fully acceptable substitute so far as appearance is concerned to the inefficient type of open fire and it will be necessary to educate the public to the fact that the extravagance of a fire designed solely for appearance can no longer be afforded.

The foregoing examples will perhaps have indicated some of the difficulties involved in the development of new appliances and how in almost all cases the final design must be a compromise between a number of conflicting requirements. In particular the sales requirements and technical requirements may often be opposed.

The ultimate designs are usually the result of close collaboration between the technical, designing, and sales staffs both of the appliance manufacturer and of the gas board. The technical staffs have to take account of the importance of the sales requirements of good appearance, convenience in use, and low cost, although of course they cannot sacrifice the essential technical requirements of safety, satisfactory functioning, and reasonable durability.

There is no perfect appliance and even when one has passed all the technical tests and has been accepted by the commercial and sales authorities, it will still be possible for a critical observer to find shortcomings. To different consumers various requirements assume different importance and the policy of the gas industry to provide in their showrooms a reasonably large number of examples of each type of appliance is therefore well suited to meet the varied tastes of the public.

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*APPLICATION OF GAS TURBINES—*

*(Concluded from p. 480)*

make the best possible use of it. The field of application to such machines was therefore very limited, and the only water authority which had so far ordered any was the Metropolitan Water Board. The cost of a turbine such as the Allen machine must be about £30 to £40 per kW, whereas the same firm would probably supply a medium speed diesel engine of comparable power and proved reliability for £5 or £10 per kW less. On the other hand, the gas turbine showed savings in the cost of foundations, enclosing building and maintenance. If blading was kept clean there could be little required other than taking up bearings occasionally. He enquired about the noise of the turbine, particularly with regard to its possible operation in urban areas.

There was a field, continued Mr. Lupton, for turbines for driving portable plant in order to reduce the weight and to make transport easy, factors which might be more important than fuel consumption. For instance, the average 100 cu.ft. portable air compressor driven by a diesel engine weighed nearly two tons at the present time. Whereas electric motors were commonly sold as having an efficiency expressed as a percentage of the perfect machine, tests at the makers' works were conducted on the basis of measurement of the various losses—a much better proceeding for any engineer with any kind of engine.

**Mr. Pope,** replying briefly to the discussion, said that he had been considering the long-life turbine with a temperature of 600°C. at the inlet—having a life of 15 to 20 years. As regards noise, their test plant was installed in the middle of a housing estate—the nearest house being within 20 yds. They had silenced the plant so effectively that the residents of the houses scarcely knew when the turbine was running. They had introduced splitter boards set at angles so that the gas followed a zig-zag path. The plant was housed in a brick building and exhausted up a chimney which had a little sound absorbent material round the lower 20 ft. He assured them there was no need to worry about noise. With lagging on the plant it was possible to talk in a normal voice inside the building. Most filters contaned zig-zag sheets of cloth holding wool and presenting a large area to the incoming air. These had operated very satisfactorily on industrial sites. Gasworks did, of course, present a very stringent application in this respect.

A vote of thanks to the author was accorded on the proposition of **Mr. W. A. Evetts** (Eastern), seconded by **Dr. J. Burns** (North Thames), the latter observing that the gas turbine was a development of major importance to the industry.

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Owing to transposition of diagrams in the original preprint of Mr. Pope's paper, Fig. 1 in our abstract (*Journal* of February 6, p. 364) should be ignored.

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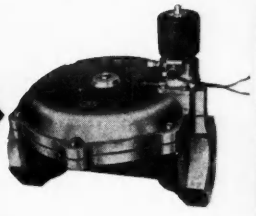

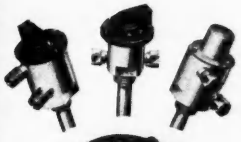

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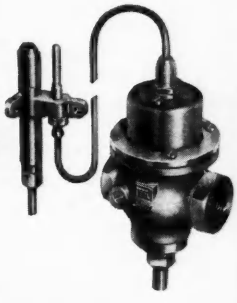

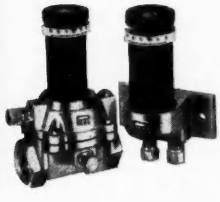

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## CONTENTS

Page

EDITORIAL COMMENT

Oxford Gasworks ... 517
Corrosion ... 518
Paint and Painting ... 518
Gas Service Conference ... 519
Taxpayers and the Budget ... 519
Industrial Wales ... 519

LETTERS TO THE EDITOR

The 'R' Ratio. H. B. Avery and R. F. Twist ... 520

NEWS OF CURRENT EVENTS

Personal ... 520
Diary ... 520
News in Brief ... 521
New Fylde Gas Link Opened ... 521
Gas Water Heater Production ... 521
Gas in Industry Exhibition ... 522
Llanelly Branch, Women's Gas Federation ... 522
East Midlands Gas Board Training Centre at Long Eaton ... 523
More Gas for Wigan ... 524
Wallingford Closing Down ... 524
Nursing Students Visit Radiation ... 524
'Founded on Fact' ... 528
Smethwick Industry ... 536
New Companies Registered in 1951 ... 537

COMPANY NEWS

Midland Tar Distillers; Powers-Samas; George Cohen, Son & Co., Ltd.; Staveley Investment Trust; Metropolitan Gas Meters, Ltd.; Power Gas Corporation; Colonial Gas Association ... 537

TECHNICAL RECORD

The Development of a Temperature Limit and Overheat Control. By N. D. B. Harris, Assoc.M.Inst. Gas E., North Thames Gas Board ... 525
Unaccounted-for Gas. Midland Section, Institution of Gas Engineers, Discussion on Report of Institution Sub-Committee ... 529
Power Generation in Gasworks. By W. A. Train, W. H. Allen, Sons & Co., Ltd., Bedford ... 535

TRADE NEWS

New Cannon Cooker; Falk, Stadelmann & Co, Ltd.; James Stott & Co. (Engineers), Ltd.; Fisher Governor Co., Ltd.; Volcano Heaters; Babcock and Wilcox, Ltd.; Trade Publications; Mercol Products; Oxy-Town Gas Flame Hardening ... 540

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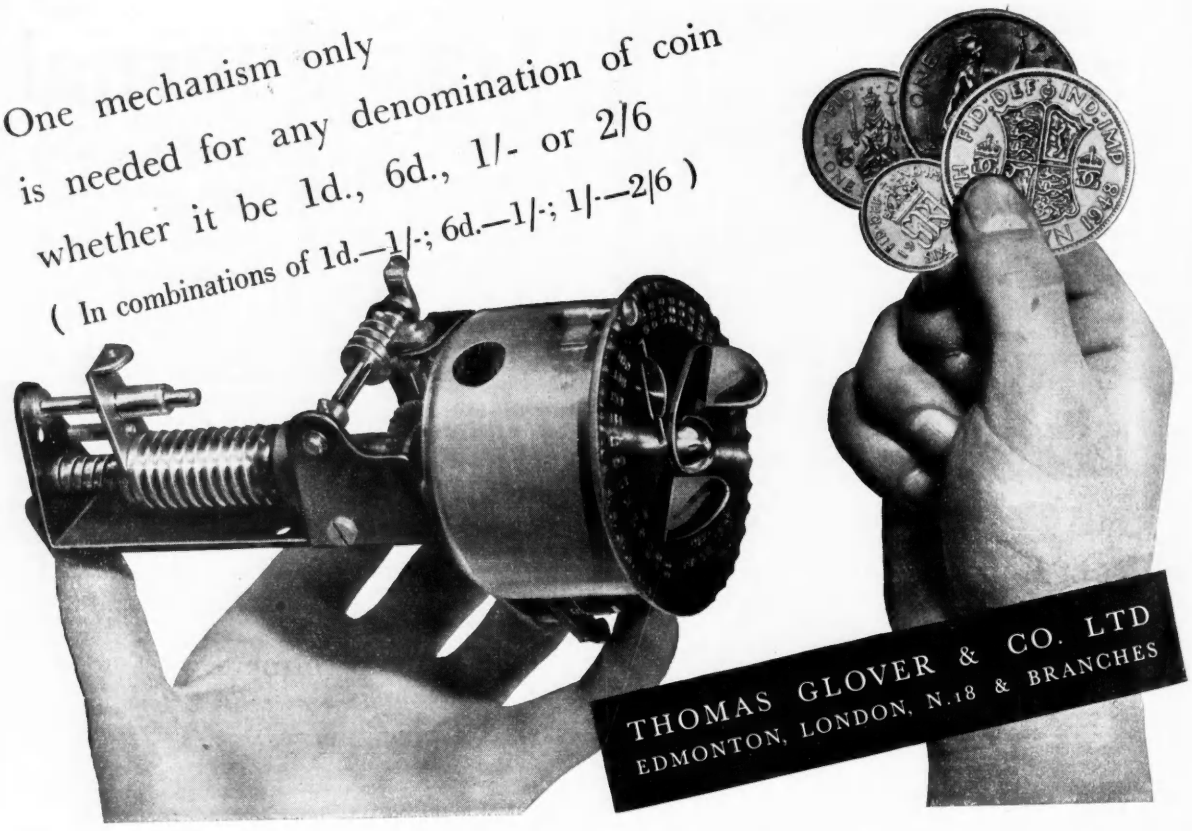

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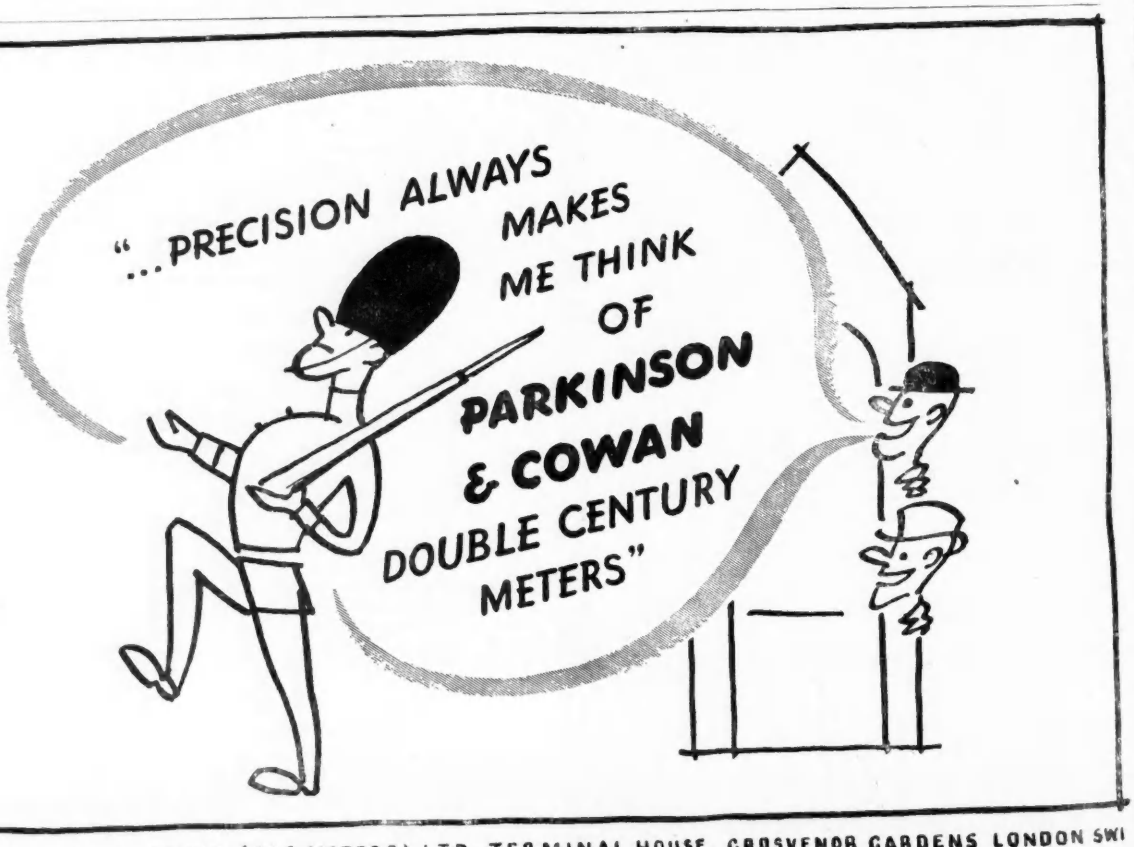


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